-> AREA = AOC 22

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
manganese	18	50	804.5	491.7731	1187.832
		84.13	2439.596	1041.8	3180*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-> AREA = Background

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
manganese	11	50	820	498.5418	897.5709
		84.13	1058.104	858.5815	2270*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-> AREA = S. Exposure Area Rev

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
manganese	121	50	2160	1660.509	3225.287
		84.13	5018.316	4541.042	5718.764

. bysort AREA: centile vanadium, centile (50, 84.13)

-> AREA = AOC 13

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
vanadium	27	50	18.1	16.39323	25.73688
		84.13	35.63384	26.06291	44.70733

-> AREA = AOC 22

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
vanadium	18	50	15	11.24807	20.44437
		84.13	24.59694	18.94844	30.5*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-> AREA = Background

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
vanadium	11	50	21.2	11.97018	30.12291
		84.13	31.20152	24.39769	35*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-> AREA = S. Exposure Area Rev

```
                                                       -- Binom. Interp. --
    Variable |      Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
    vanadium |      121         50         25.6        22.02102    28.17898
             |               84.13     41.32772        37.95209    45.77025

. bysort AREA: centile  bapte, centile (50, 84.13)

-----------------------------------------------------------------------------------
-> AREA = AOC 13

                                                       -- Binom. Interp. --
    Variable |      Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
       bapte |       27         50       .90129        .4849347     1.64244
             |               84.13     13.81089        1.719982    50.98923

-----------------------------------------------------------------------------------
-> AREA = AOC 22

                                                       -- Binom. Interp. --
    Variable |      Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
       bapte |       18         50      1.26282        .6247859    2.631954
             |               84.13      36.4631        2.040069    52.7858*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-----------------------------------------------------------------------------------
-> AREA = Background

                                                       -- Binom. Interp. --
    Variable |      Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
       bapte |       10         50      1.04144        .3475199     3.66306
             |               84.13     5.394327        1.232003    10.4325*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-----------------------------------------------------------------------------------
-> AREA = S. Exposure Area Rev

                                                       -- Binom. Interp. --
    Variable |      Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
       bapte |      119         50      .953285        .7749577    1.313507
             |               84.13     5.599589        3.610209    8.281048

. edit
- preserve

. save "J:\Indl_Service\Project Files\AKSteel (see Rem-Eng P00)\Hamilton, Ohio\HHRA\
    Background Evaluation\SS.dta"
file J:\Indl_Service\Project Files\AKSteel (see Rem-Eng P00)\Hamilton, Ohio\HHRA\Background
    Evaluation\SS.dta sav
> ed
. log close
        log:  J:\Indl_Service\Project Files\AKSteel (see Rem-Eng P00)\Hamilton, Ohio\HHRA\
                Background Evaluation\SS
> .smcl
  log type:  smcl
 closed on:  14 Oct 2008, 16:12:46
---------------------------------------------------------------------------------------------
    --------------------
```

Attachment I-3b:

Stata output: 84.13th and 50th percentiles (Combined Soil)

```
----------------------------------------------------------------------------------
      ---------------------
       log:  J:\Indl_Service\Project Files\AKSteel (see Rem-Eng P00)\Hamilton, Ohio\HHRA\
          Background Evaluation\Co
> mbinedSoil.smcl
  log type:  smcl
 opened on:  15 Oct 2008, 08:44:41

. edit
(1 var, 199 obs pasted into editor)
(1 var, 198 obs pasted into editor)
(1 var, 198 obs pasted into editor)
(1 var, 198 obs pasted into editor)
(1 var, 198 obs pasted into editor)
(1 var, 198 obs pasted into editor)
(1 var, 198 obs pasted into editor)
(1 var, 198 obs pasted into editor)
- preserve

. bysort AREA: centile aluminum, centile (50, 84.13)

--------------------------------------------------------------------------
-> AREA = AOC 13

                                                       -- Binom. Interp. --
    Variable |     Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
    aluminum |      79          50        11800        7800.737       13100
             |               84.13      21543.2        17351.16    23930.01

--------------------------------------------------------------------------
-> AREA = Background

                                                       -- Binom. Interp. --
    Variable |     Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
    aluminum |      20          50         8205          5038.2    12653.41
             |               84.13     16267.87           12300      31600*

* Lower (upper) confidence limit held at minimum (maximum) of sample

--------------------------------------------------------------------------
-> AREA = S. Exposure Area Rev

                                                       -- Binom. Interp. --
    Variable |     Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
    aluminum |     240          50        14800        13465.28       16100
             |               84.13     27601.32         25600.7       30300

. bysort AREA: centile arsenic, centile (50, 84.13)

--------------------------------------------------------------------------
-> AREA = AOC 13

                                                       -- Binom. Interp. --
    Variable |     Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
     arsenic |      79          50          6.4        5.654035    7.745965
             |               84.13      11.5868         9.25116    13.54231

--------------------------------------------------------------------------
-> AREA = Background

                                                       -- Binom. Interp. --
    Variable |     Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
```

arsenic	20	50	9.75	7.8	14.46706
		84.13	34.20228	12.33964	68.5*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-> AREA = S. Exposure Area Rev

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
arsenic	240	50	7.8	7	8.8
		84.13	11.8	11.2	13.10234

. bysort AREA: centile iron, centile (50, 84.13)

-> AREA = AOC 13

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
iron	79	50	14600	12627.02	17956.84
		84.13	29704	22002.32	40384.62

-> AREA = Background

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
iron	20	50	19400	17046.59	21730.12
		84.13	30971.1	21079.88	132000*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-> AREA = S. Exposure Area Rev

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
iron	240	50	23500	21161.13	25300
		84.13	71729.95	57205.64	85739.13

. bysort AREA: centile lead, centile (50, 84.13)

-> AREA = AOC 13

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
lead	79	50	16.3	12.42702	20.28649
		84.13	46.9264	30.4279	127.6487

-> AREA = Background

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
lead	20	50	22.35	15.13976	56.35941
		84.13	182.6178	49.69822	2230*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-> AREA = S. Exposure Area Rev

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
lead	240	50	19.95	17.23057	22.2083
		84.13	83.2066	63.5141	123.9197

. bysort AREA: centile manganese, centile (50, 84.13)

-> AREA = AOC 13

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
manganese	79	50	636	455.214	797.8386
		84.13	2029.52	1418.602	2777.54

-> AREA = Background

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
manganese	20	50	722	515.2976	871.1365
		84.13	914.8622	849.5927	2270*

* Lower (upper) confidence limit held at minimum (maximum) of sample

-> AREA = S. Exposure Area Rev

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
manganese	240	50	1255	997.6113	1620.83
		84.13	4457.533	4120.564	4903.679

. bysort AREA: centile vanadium, centile (50, 84.13)

-> AREA = AOC 13

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
vanadium	79	50	17.1	15.01614	21.01088
		84.13	33.56	28.85116	39.49385

-> AREA = Background

Variable	Obs	Percentile	Centile	-- Binom. Interp. -- [95% Conf.	Interval]
vanadium	20	50	25.45	14.04259	30.68935
		84.13	35.06673	29.55971	59.3*

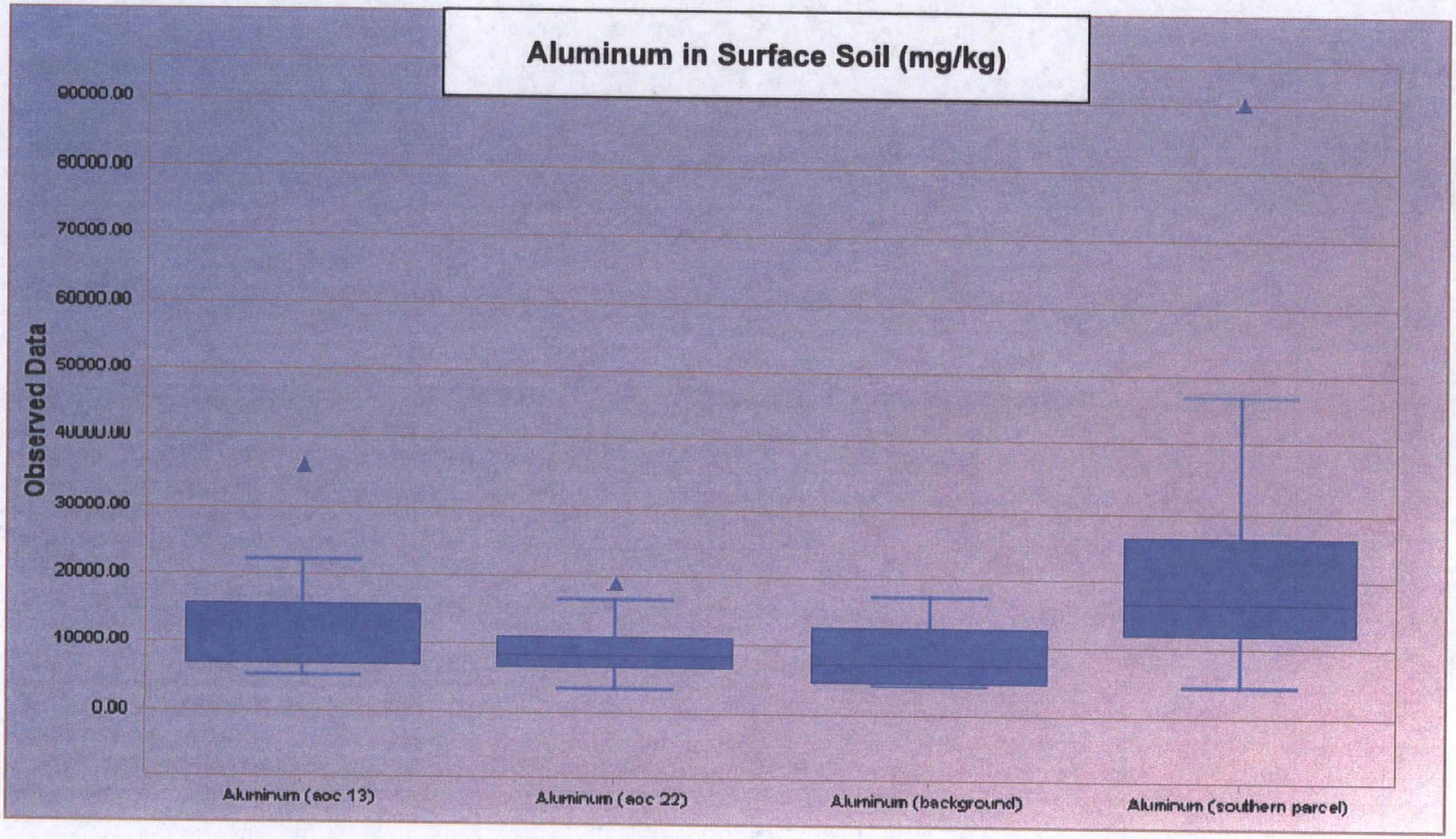
* Lower (upper) confidence limit held at minimum (maximum) of sample

-> AREA = S. Exposure Area Rev

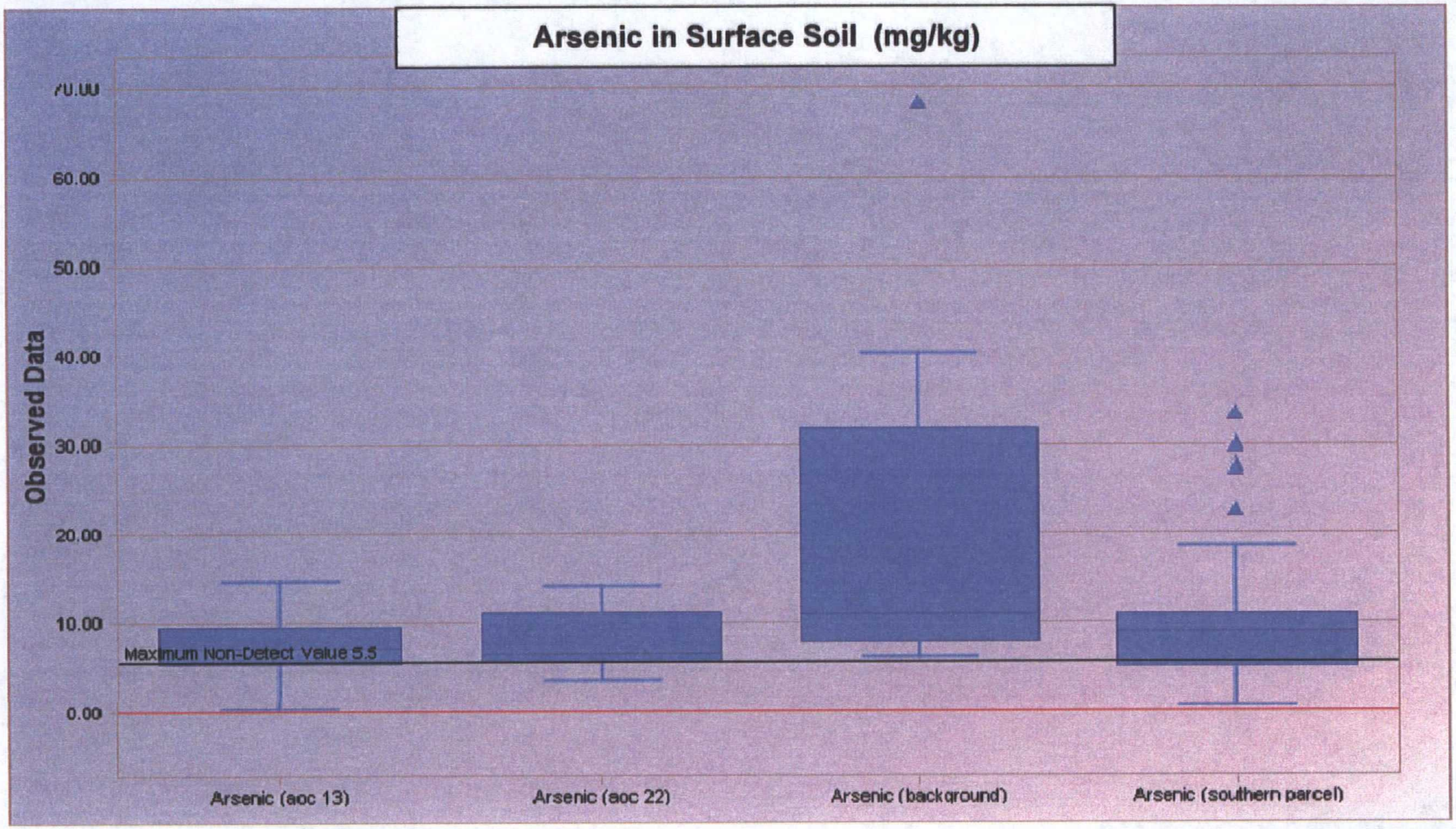
```
                                                          -- Binom. Interp. --
    Variable |       Obs  Percentile      Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
    vanadium |       240         50        21.75               20        24.6
             |                84.13         39.7         36.10141    41.62074

. save "J:\Indl_Service\Project Files\AKSteel (see Rem-Eng P00)\Hamilton, Ohio\HHRA\
    Background Evaluation\Combine
> dSoil.dta"
file J:\Indl_Service\Project Files\AKSteel (see Rem-Eng P00)\Hamilton, Ohio\HHRA\Background
    Evaluation\CombinedSo
> il.dta saved

. log close
       log:  J:\Indl_Service\Project Files\AKSteel (see Rem-Eng P00)\Hamilton, Ohio\HHRA\
           Background Evaluation\Co
> mbinedSoil.smcl
  log type:  smcl
 closed on:  15 Oct 2008, 08:47:18
-------------------------------------------------------------------------------------------
    ---------------------
```

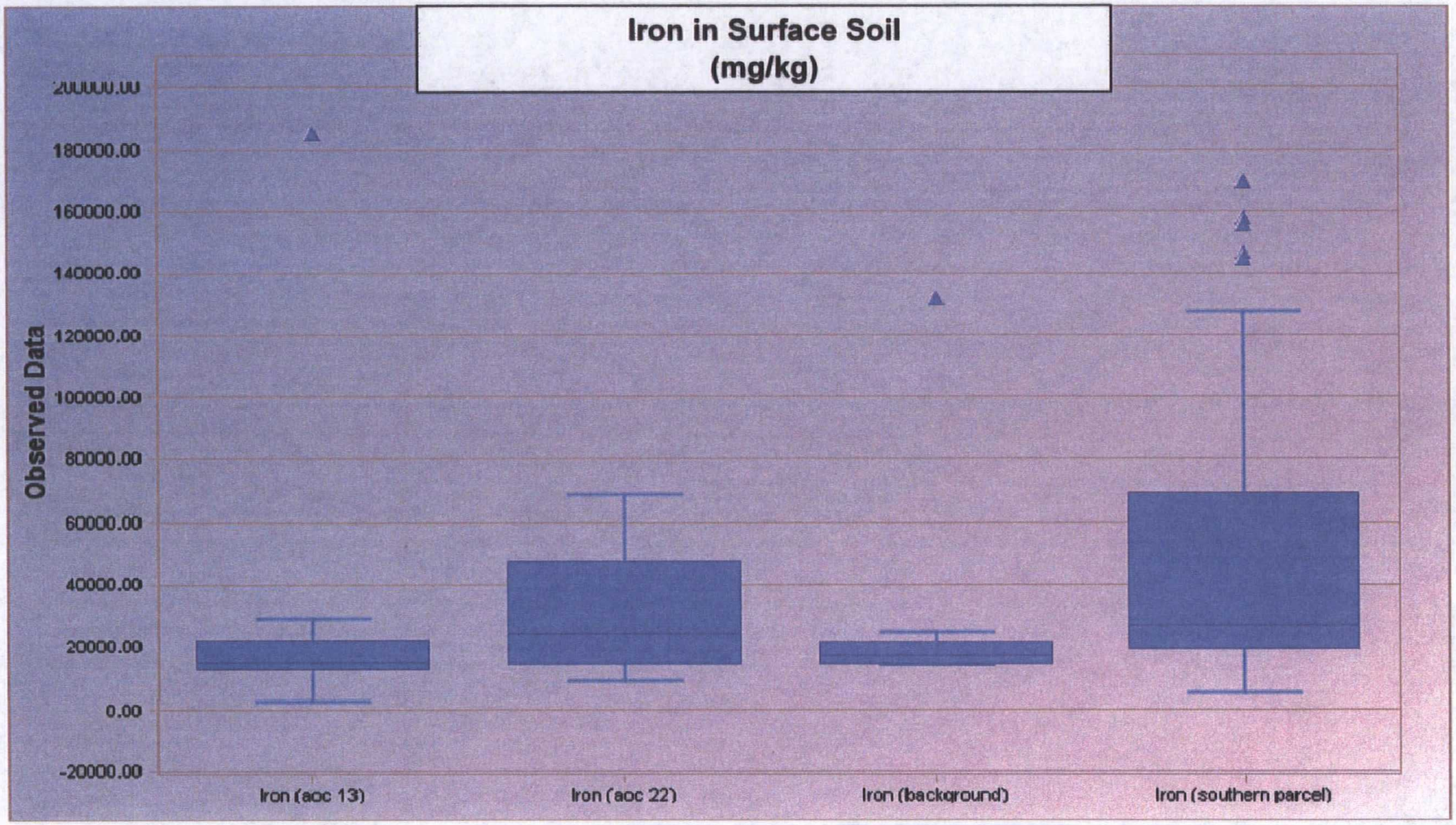
Attachment I-4a:

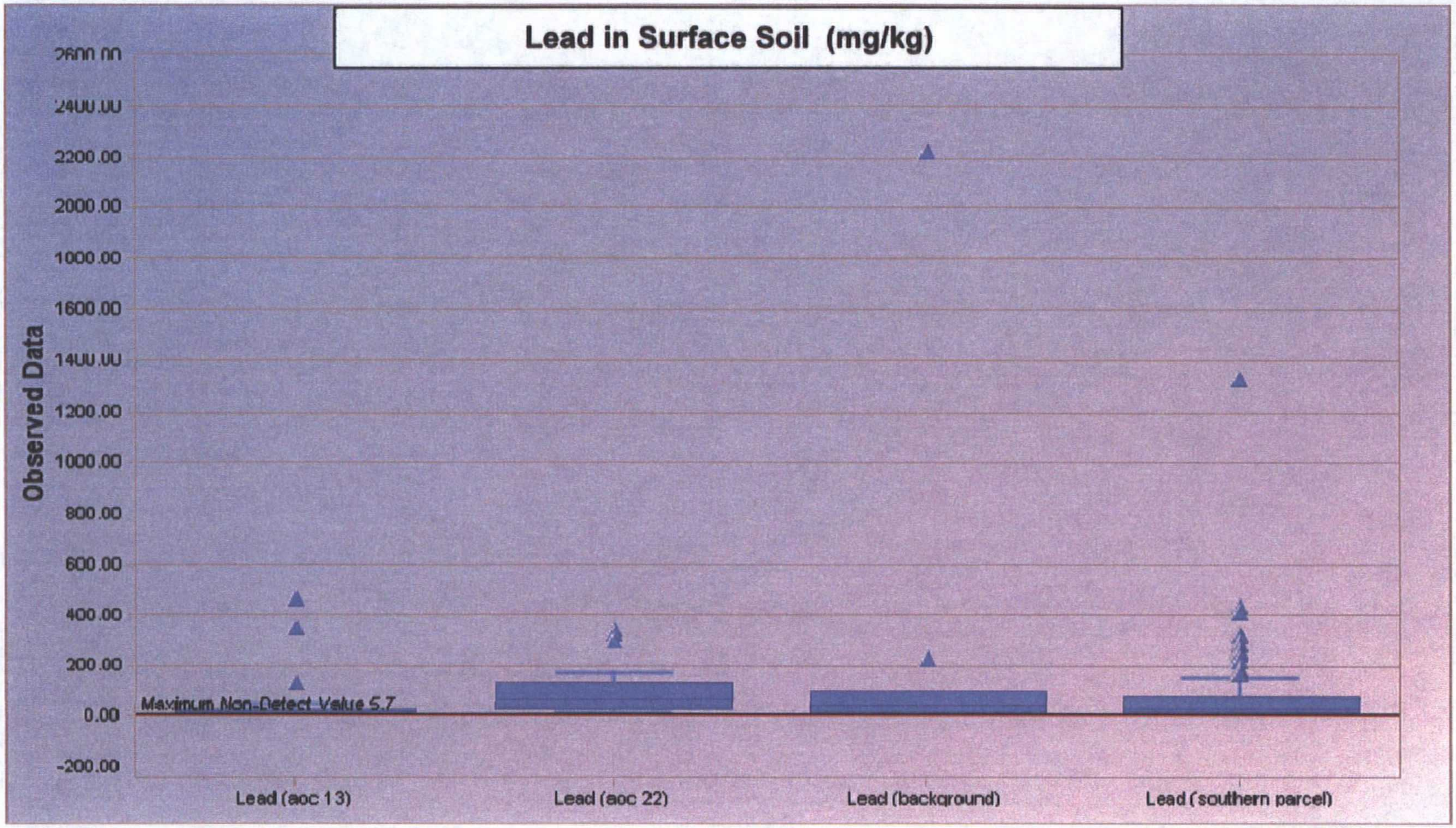
ProUCL box plots (Surface Soil)



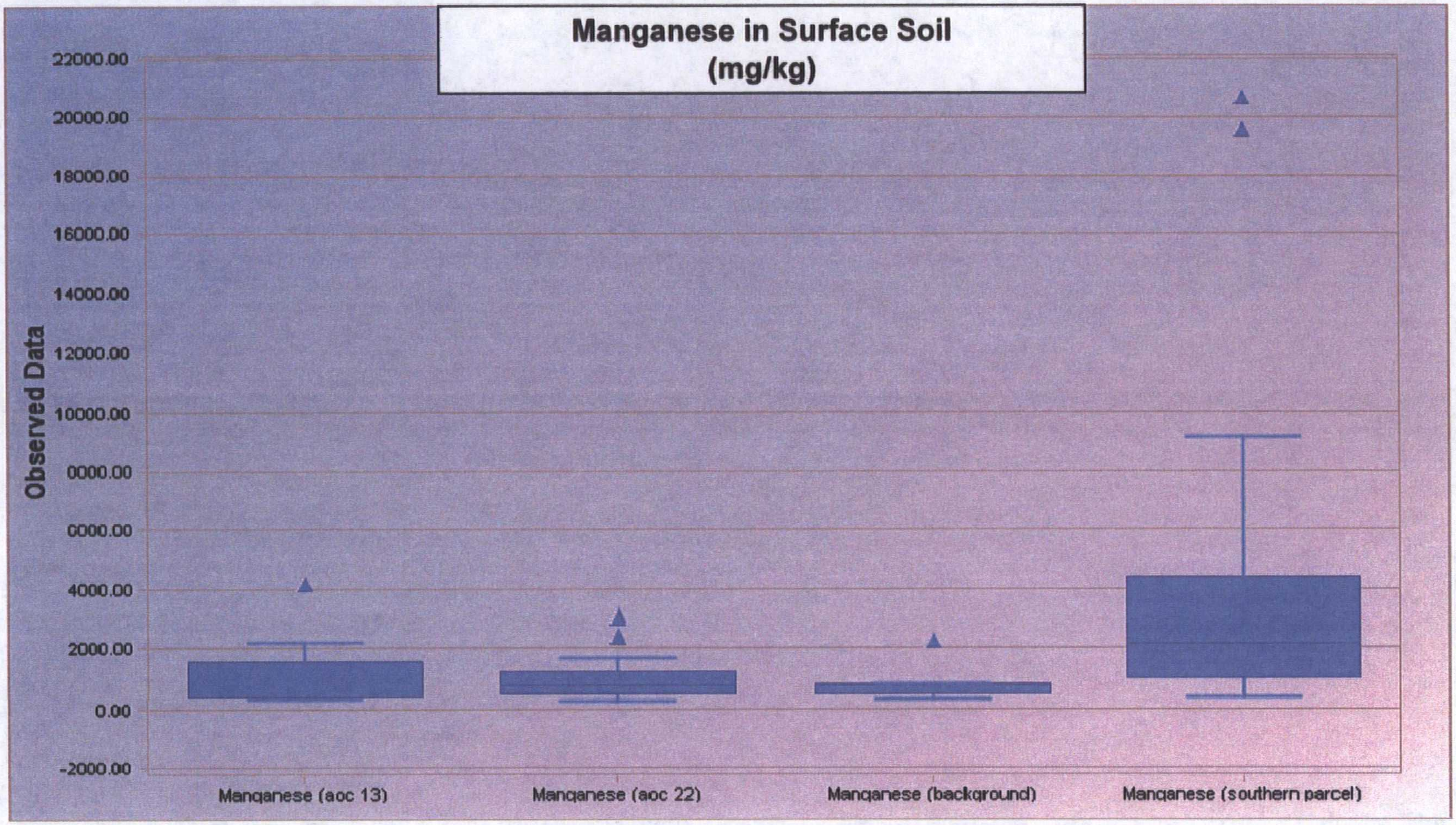
Aluminum in Surface Soil (mg/kg)
Observed Data
90000.00
80000.00
70000.00
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
Aluminum (aoc 13)
Aluminum (aoc 22)
Aluminum (background)
Aluminum (southern parcel)

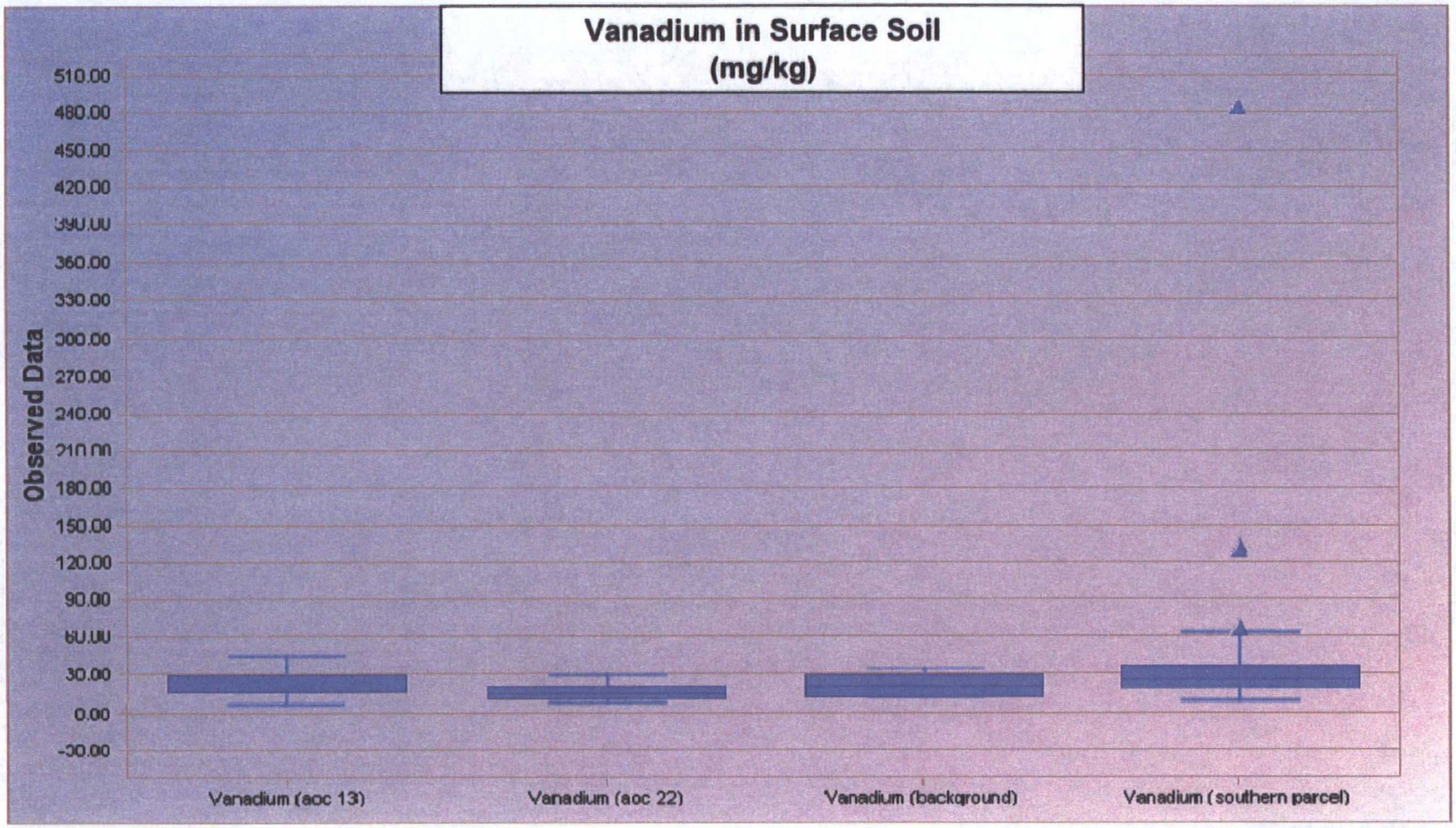

Arsenic in Surface Soil (mg/kg)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Observed Data
Maximum Non-Detect Value 5.5
Arsenic (aoc 13)
Arsenic (aoc 22)
Arsenic (background)
Arsenic (southern parcel)

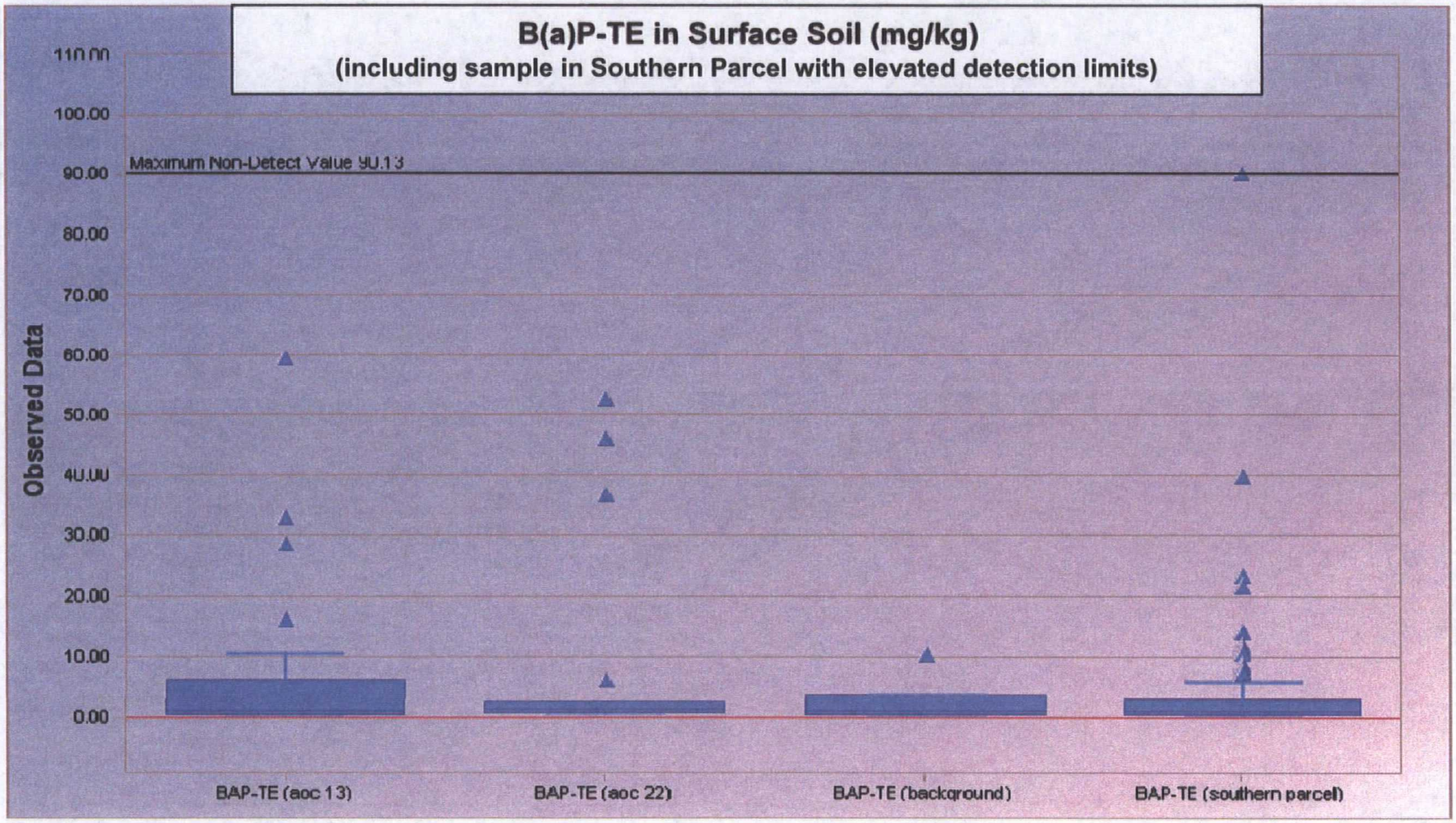

Iron in Surface Soil
(mg/kg)
Observed Data
200000.00
180000.00
160000.00
140000.00
120000.00
100000.00
80000.00
60000.00
40000.00
20000.00
0.00
-20000.00
Iron (aoc 13)
Iron (aoc 22)
Iron (background)
Iron (southern parcel)

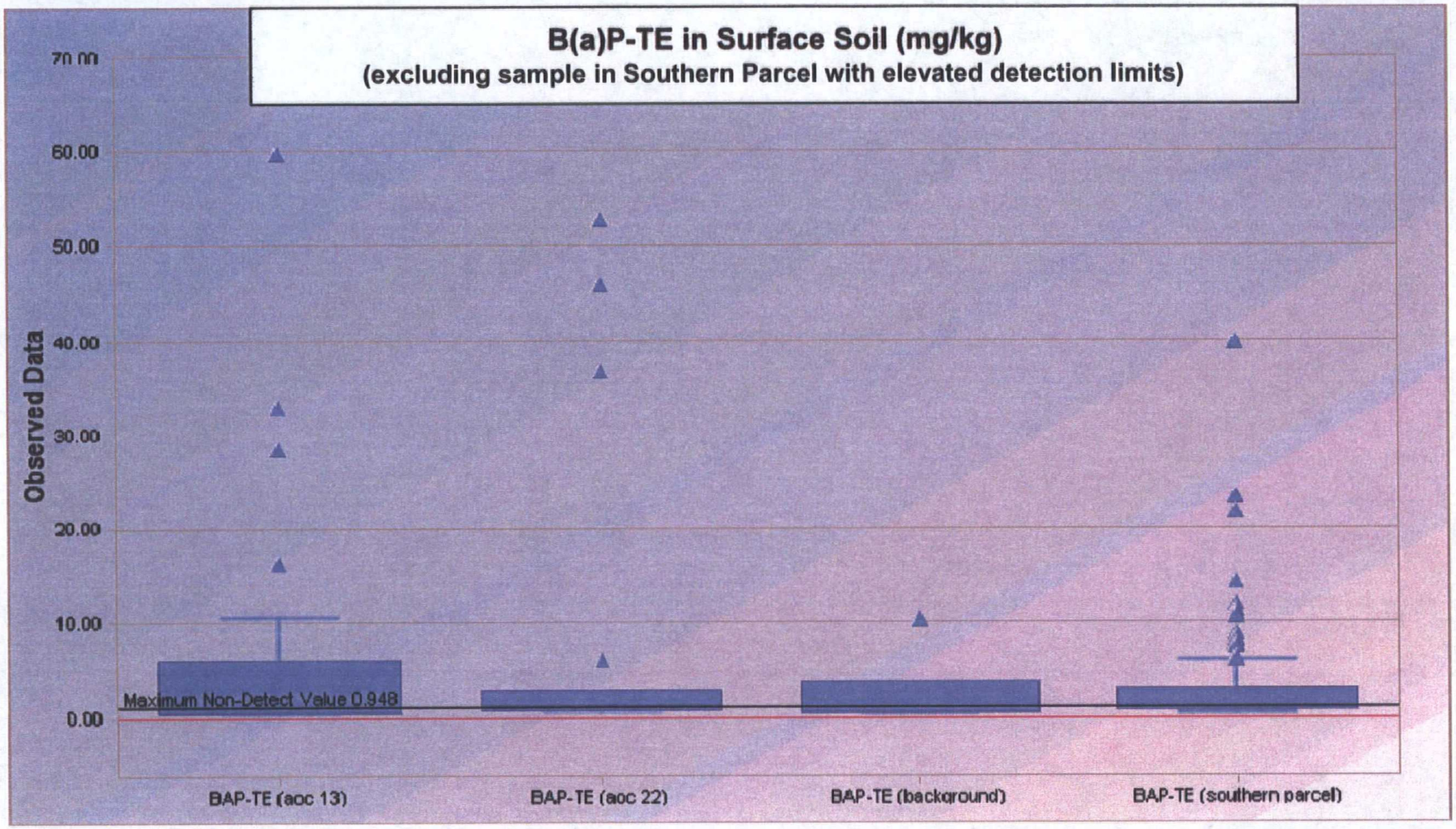


Lead in Surface Soil (mg/kg)
Observed Data
2600.00
2400.00
2200.00
2000.00
1800.00
1600.00
1400.00
1200.00
1000.00
800.00
600.00
400.00
200.00
0.00
-200.00
Maximum Non-Detect Value 5.7
Lead (aoc 13)
Lead (aoc 22)
Lead (background)
Lead (southern parcel)


Manganese in Surface Soil
(mg/kg)
Observed Data
22000.00
20000.00
18000.00
16000.00
14000.00
12000.00
10000.00
0000.00
0000.00
4000.00
2000.00
0.00
-2000.00
Manganese (aoc 13)
Manganese (aoc 22)
Manganese (background)
Manganese (southern parcel)

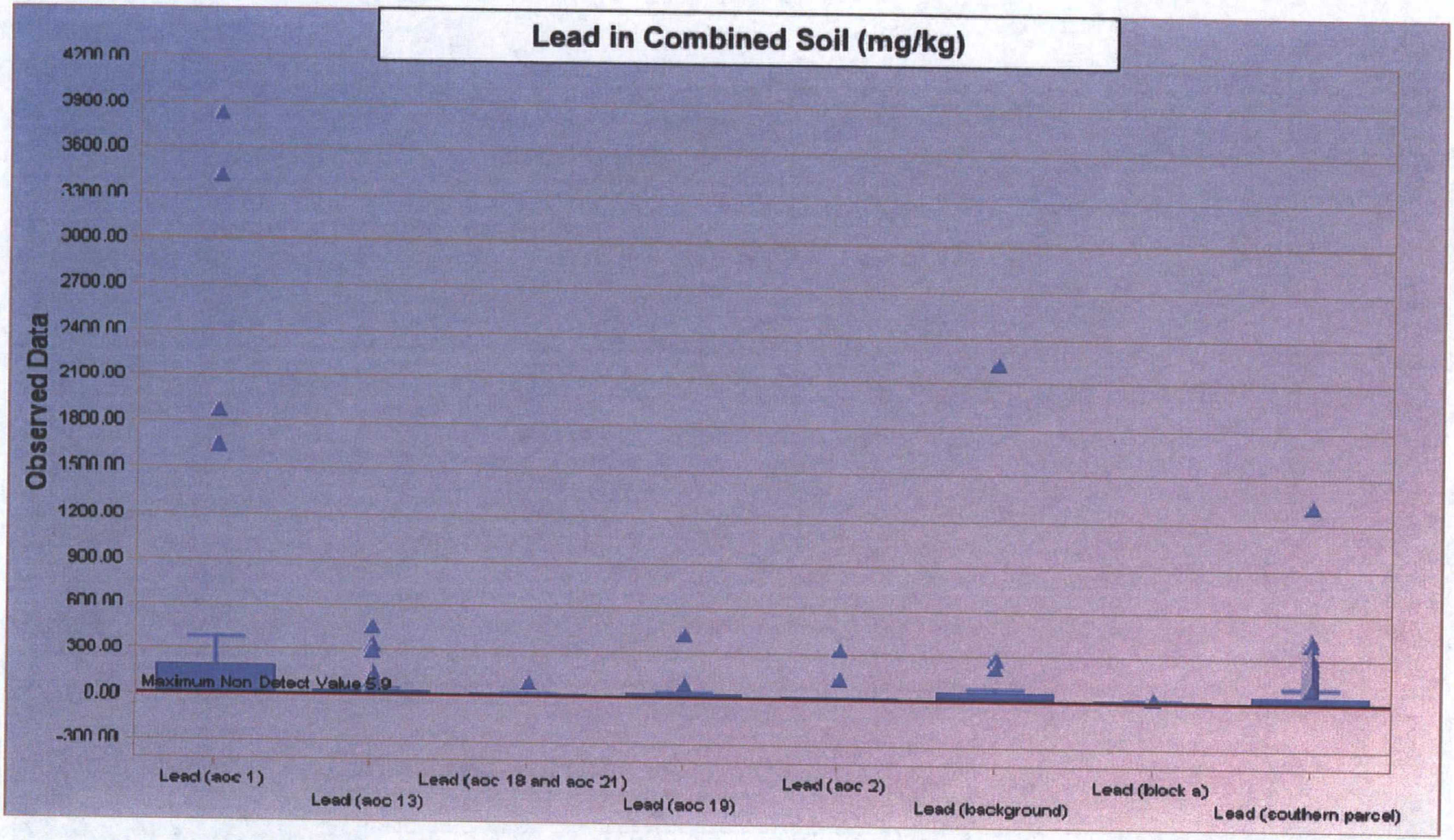

Vanadium in Surface Soil
(mg/kg)
Observed Data
510.00
480.00
450.00
420.00
390.00
360.00
330.00
300.00
270.00
240.00
210.00
180.00
150.00
120.00
90.00
60.00
30.00
0.00
-30.00
Vanadium (aoc 13)
Vanadium (aoc 22)
Vanadium (background)
Vanadium (southern parcel)

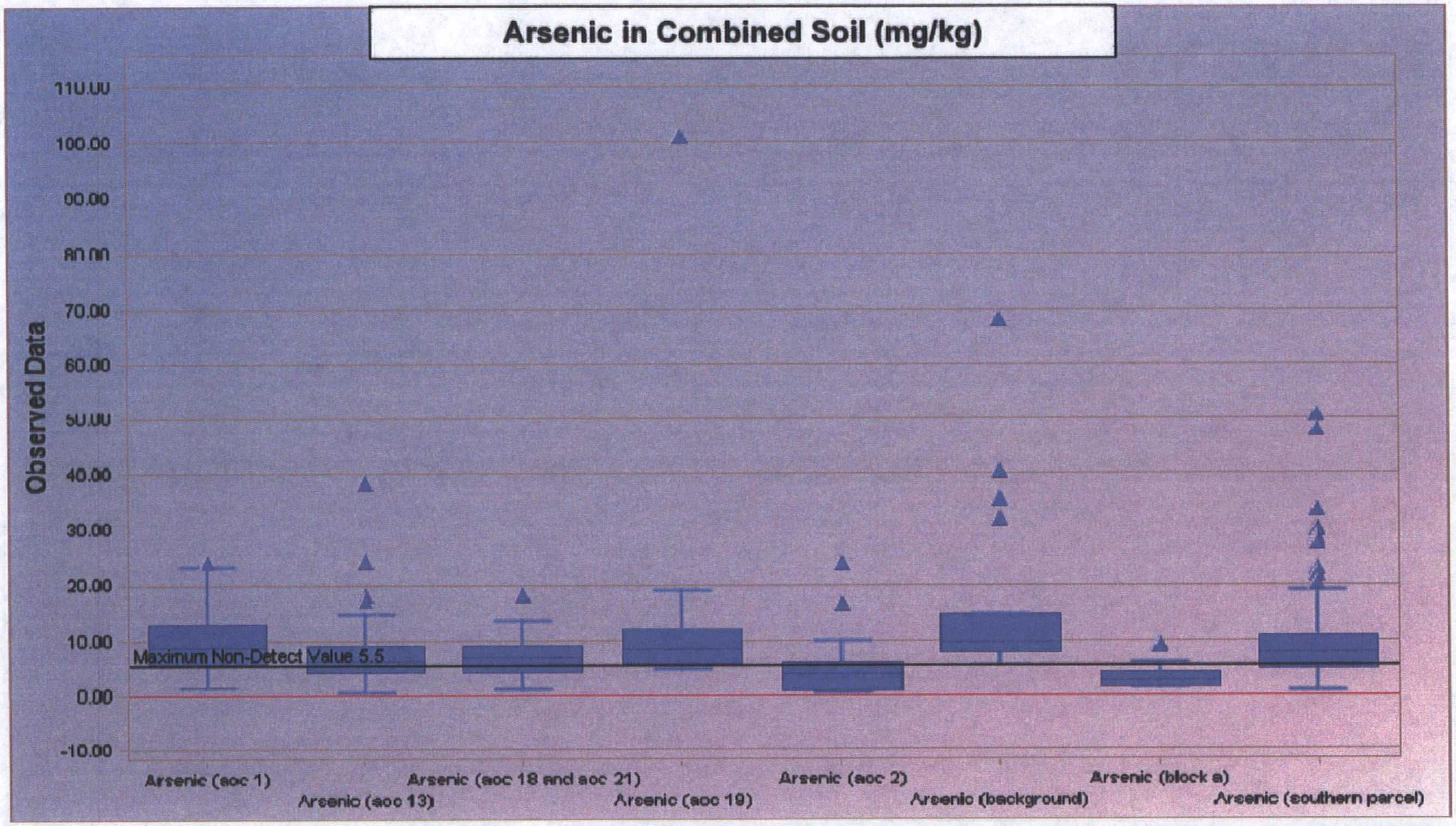

B(a)P-TE in Surface Soil (mg/kg)
(including sample in Southern Parcel with elevated detection limits)
Maximum Non-Detect Value 90.13
Observed Data
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
BAP-TE (aoc 13)
BAP-TE (aoc 22)
BAP-TE (background)
BAP-TE (southern parcel)


B(a)P-TE in Surface Soil (mg/kg)
(excluding sample in Southern Parcel with elevated detection limits)
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
Observed Data
Maximum Non-Detect Value 0.948
BAP-TE (aoc 13)
BAP-TE (aoc 22)
BAP-TE (background)
BAP-TE (southern parcel)

Attachment I-4b:

ProUCL box plots (Combined Soil)


Lead in Combined Soil (mg/kg)
Observed Data
4200.00
3900.00
3600.00
3300.00
3000.00
2700.00
2400.00
2100.00
1800.00
1500.00
1200.00
900.00
600.00
300.00
0.00
-300.00
Maximum Non Detect Value 5.9
Lead (aoc 1)
Lead (aoc 13)
Lead (aoc 18 and aoc 21)
Lead (aoc 19)
Lead (aoc 2)
Lead (background)
Lead (block a)
Lead (southern parcel)



Arsenic in Combined Soil (mg/kg)
Observed Data
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
Maximum Non-Detect Value 5.5
Arsenic (aoc 1)
Arsenic (aoc 13)
Arsenic (aoc 18 and aoc 21)
Arsenic (aoc 19)
Arsenic (aoc 2)
Arsenic (background)
Arsenic (block a)
Arsenic (southern parcel)

ENSR | AECOM

Appendix J
Shower Model

TABLE J-1
CALCULATION OF CHEMICAL VAPOR CONCENTRATIONS IN SHOWER STALL AIR (a)
ADULT RESIDENT - RME
AK STEEL FORMER ARMCO HAMILTON PLANT
NEW MIAMI, BUTLER COUNTY, OHIO
BASELINE HUMAN HEALTH RISK ASSESSMENT

Non-Chemical Specific Parameters

Shower stall volume (m^3) (V_a)	1.50E+00	
Duration of shower (min) ("t")	3.48E+01	(b)
Water flow rate in shower (liters/min) (F_r)	1.00E+01	
Volume of water (m^3) (V_w)	3.48E-01	(F_r x t/1000 L/m3)
Shower water temperature (°C)	4.00E+01	

Chemical	CAS	Concentration in Water (C_w) (mg/L)	Henry's Law Constant (H) (c) (dimensionless)	Shower Air Concentration (C_a) (mg/m³) (d)
1-Methylnaphthalene	90-12-0	1.59E-01	2.02E-02	2.94E-03
2-Methylnaphthalene	91-57-6	3.42E-01	2.02E-02	6.35E-03
Benzene	71-43-2	5.46E-03	2.17E-01	6.12E-04
Naphthalene	91-20-3	5.14E-01	1.89E-02	8.97E-03

Notes:
CAS - Chemical Abstracts Service.
USEPA - United States Environmental Protection Agency
(a) Based on the screening model of Paul Sanders, NJDEP, 2002.
(b) - USEPA, 1997a. Exposure Factors Handbook. Recommended 95th percentile value for time spent showering (adult). EFH Table 1-2. USEPA, 2004e. Risk Assessment Guidance for Superfund, Supplemental Guidance for Dermal Risk Assessment. Exhibit 3-2, recommended value.
(c) Henry's law constant assuming water temperature of 40 degrees Celsius.
Converted from values in USEPA, 1996. Soil Screening Guidance. Technical Background Document. EPA/540/R-95/128. *Table C-1.*
No values available from this source for 2-methylnaphthalene. Therefore, value from the USEPA version of the Johnson and Ettinger Model (USEPA, 2003b)was used.
The 2-methylnaphthalene value was also used for 1-methylnaphthalene.

(d) Sanders (2002) Equation:

$$C_a\,(mg/m^3) = C_w\,(mg/L)\;\frac{H^*V_w\,(m^3)}{(H^*V_a\,(m^3)) + (V_w\,(m^3))}$$

TABLE J-2
CALCULATION OF CHEMICAL VAPOR CONCENTRATIONS IN BATHTUB AIR (a)
CHILD RESIDENT (RME AND CTE)
AK STEEL FORMER ARMCO HAMILTON PLANT
NEW MIAMI, BUTLER COUNTY, OHIO
BASELINE HUMAN HEALTH RISK ASSESSMENT

Non-Chemical Specific Parameters

Bathtub stall volume (m^3) (V_a)	1.50E+00	
Duration of flow from tap into tub (min) ("t")	5.00E+00	(b)
Water flow rate in tap (liters/min) (F_r)	1.00E+01	
Volume of water (m^3) (V_w)	5.00E-02	(F_r x t/1000 L/m3)
Tub water temperature (°C)	4.00E+01	

Chemical	CAS	Concentration in Water (C_w) (mg/L)	Henry's Law Constant (H) (c) (dimensionless)	Bathtub Air Concentration (C_a) (mg/m^3) (d)
1-Methylnaphthalene	90-12-0	1.59E-01	2.02E-02	1.99E-03
2-Methylnaphthalene	91-57-6	3.42E-01	2.02E-02	4.30E-03
Benzene	71-43-2	5.46E-03	2.17E-01	1.58E-04
Naphthalene	91-20-3	5.14E-01	1.89E-02	6.19E-03

Notes:
CAS - Chemical Abstracts Service.
USEPA - United States Environmental Protection Agency
(a) Based on the screening model of Paul Sanders, NJDEP, 2002.
(b) Model was developed for a shower. To adjust for a bathtub scenario, the duration of the flow from the tap to tub was set to 5 minutes, assuming that once the bathtub is filled, the water is turned off.
(c) Henry's law constant assuming water temperature of 40 degrees Celsius, which is conservative for a child's bathing temperature.
Converted from values in USEPA, 1996. Soil Screening Guidance. Technical Background Document. EPA/540/R-95/128. Table C-1.
No values available from this source for 2-methylnaphthalene. Therefore, value from the USEPA version of the Johnson and Ettinger Model (USEPA, 2003b) was used.
The 2-methylnaphthalene value was also used for 1-methylnaphthalene.

(d) Sanders (2002) Equation:

$$C_a\ (mg/m^3) = C_w\ (mg/L)\ \frac{H*V_w\ (m^3)}{(H*V_a\ (m^3)) + (V_w\ (m^3))}$$

Appendix K
Response to Comment Documentation

GENERAL COMMENTS

USEPA Comment:

1. The draft HHRA defines chemicals of concern (COC) as chemicals of potential concern (COPC) associated with a risk greater than 1E-04 or a hazard greater than 1. COCs should be defined based on the lower end of the risk range, 1E-06, rather than on the upper end of EPA's acceptable risk range of 10^{-4} to 10^{-6}. There are several reasons for this approach. First and foremost, risk managers may require remediation for any risks that exceed 1E-06. Risk managers will not be adequately informed unless the chemicals associated with risks greater than 1E-06 are defined. Second, receptors may be exposed to multiple chemicals through a variety of exposure pathways. Although risks associated with each of these combinations of chemicals and exposure pathways may be less than 1E-04, the sum of chemical-specific risks may exceed 1E-04. The draft HHRA should be revised accordingly.

AK Steel Response:

The HHRA will be revised to identify in the Risk Characterization (Section 6.3) chemicals with a cumulative risk greater than 1E-06. Based on a September 20, 2007 discussion with USEPA's contractor, TetraTech, it is understood that not all chemicals with risk greater than 1E-06 will necessarily be identified as COCs and thus require calculation of remediation goals or CTE risk estimates. However, this information will be provided with the intent of providing risk managers and the public with a full understanding of potential site risks.

The identification of COCs and calculation of remediation goals will be based on the target risk level set for the site. Consistent with USEPA guidance and precedent at other sites in Region 5 and in other EPA regions, it is AK Steel's position that no remedial action is warranted based on human health (and thus no COCs need to be identified) if the cumulative receptor risk does not exceed 1E-04. USEPA states in *Role of Baseline Risk Assessment in Superfund Remedy Selection Decisions* (OSWER Directive #9355.0-30, April 1991) that:

> "Where the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure for both current and future land use is less than 10^{-4}, and the non-carcinogenic hazard quotient is less than 1, action generally is not warranted, unless there are adverse environmental impacts."

The Statement of Work (SOW) for the ARMCO Hamilton site indicates that the HHRA will be conducted in accordance with USEPA guidance, which includes the 1991 OSWER Directive. Based on this guidance, remedial actions will not be recommended where the cumulative site risk is less than 1E-04. It should be noted that this approach is also consistent with other CERCLA risk assessments and risk assessment work plans under Region 5 purview (e.g., Sauget Area 1, Illinois – risk assessment has been accepted by Region 5, and Sauget Area 2, Illinois – risk assessment work plan has been accepted by Region 5).

USEPA Comment:

2. Significant problems were identified in some of the statistical procedures used in the draft HHRA. The specific issues that involve both the procedures used to treat censored (non-detect) data and to conduct background comparisons are addressed in detail in Specific Comment 33. The draft HHRA should be revised to significantly rework the background evaluation for surface soil (Appendix I). In addition, other portions of the draft HHRA should be revised as necessary to reflect changes in the results of the revised background evaluation for surface soil.

AK Steel Response:

The overall approaches used to perform the background evaluation and calculate summary statistics, including 95 percent upper confidence limit (UCL) concentrations, are consistent with USEPA guidance in effect at the time of the draft HHRA. Use of simple substitution of ½ SQL for censored data was one of several options identified in the UCL guidance in effect at that time (USEPA, 2004). Furthermore, the approach for the background evaluation (that of the USEPA 2002 background guidance) was agreed to with USEPA and Weston Solutions over the course of several conference calls in June 2006 (although it is recognized that not every detail of the approach was discussed).

The potential effect on the risk assessment results of the procedures used to treat censored (non-detect) data are discussed in response to specific comment #1. The potential issues related to the background soil evaluation are discussed in the response to specific comment #33.

USEPA Comment:

3. Under future conditions, construction and excavation areas may bring subsurface soil to the surface. As a result, residents and industrial workers may be exposed to subsurface soil as well as to surface soil. The draft HHRA should be revised to calculate receptor-specific exposures, risks, and hazards for future residents based on potential exposure to surface soil only (already done) and for exposure to surface and subsurface soil combined.

AK Steel Response:

It is possible that hypothetical future on-site residents could be exposed to chemicals in subsurface soil that is brought to the surface during excavation and re-grading. The draft HHRA found potentially unacceptable carcinogenic risks and noncarcinogenic hazard indices for the hypothetical future on-site residential scenario for all exposure areas and for soil and/or groundwater. Given the unacceptable risks predicted for this scenario, the draft HHRA concluded in the Risk Characterization (Section 6.3.3) that further evaluation of the Hypothetical Future On-site Resident is not warranted. Rather, the draft HHRA states that institutional controls should be placed on the property such that future residential development and use of groundwater as drinking water are prohibited. Thus, in lieu of quantifying risks to the hypothetical future on-site resident from another soil pathway, potential risks associated with this pathway will be discussed qualitatively in the Risk Characterization (Section 6.3.3).

The potential for future on-site workers to be exposed to combined surface and subsurface soil (0 to 10 ft) will be considered in the revised HHRA. It should be noted that these are new pathways requested by USEPA. The subsurface soil contact pathway for the hypothetical future on-site resident or future on-site worker was not included in the EPA-approved RI/FS work plan for ARMCO Site.

USEPA Comment:

4. The draft HHRA calculates fish tissue concentrations based only on the potential bioconcentration of contaminants in surface water into tissue using chemical-specific bioconcentration factors (BCF). However, a wide variety of EPA programs and guidance documents — including EPA's Great Lakes Water Quality Initiative Technical Support Document (EPA 1995) and "Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities" (EPA 2006c) — recommend also calculating fish tissue concentrations based on potential bioaccumulation of contaminants in sediment using chemical-specific biota-sediment accumulation factors (BSAF). The draft HHRA should be revised to also calculate fish tissue concentrations based on use of chemical-specific BSAF values. These values are particularly important for polychlorinated biphenyls (PCB), which have been detected in the sediment of the Great Miami River.

AK Steel Response:

The HHRA will be revised to include fish consumption for the recreational angler based on calculation of fish tissue concentrations for PCBs using a BSAF value.

USEPA Comment:

5. The draft HHRA selects the exposure point concentrations (EPCs) for media other than groundwater in a manner (the lesser of the 95 percent upper confidence limit of

the mean [95 UCL] or the maximum detected concentration) that is consistent with EPA guidance. However, EPCs for other media are defined as the mean concentration in Sections 7.4.3 and 9.3.2, central tendency exposure (CTE) calculations. This approach is inconsistent with EPA Region 5 policy. Consistent with EPA guidance on calculating the EPC, EPA Region 5 has routinely required EPCs to be calculated as the lesser of the 95 UCL or the maximum detected concentration under both reasonable maximum exposure (RME) and CTE scenarios (EPA 1992). These two scenarios can be differentiated using different values for other exposure parameters. The draft HHRA as a whole, and Sections 7.4.3 and 9.3.2 in particular, should be revised to use the same medium-specific EPCs under both the RME and CTE scenarios. In addition, tables with EPCs should clearly state in a footnote how the EPCs were derived.

AK Steel Response:

AK Steel requests that USEPA provide a copy of the above-referenced Region 5 policy that stipulates that the lesser of the 95 UCL or the maximum detected concentration be used for CTE and RME EPCs. Neither USEPA's *Risk Assessment Guidance for Superfund* (USEPA, 1989) nor *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (USEPA, 2002) provide specific guidance regarding the concentration term for the CTE scenario. USEPA (1989) states that because of uncertainty associated with estimating the exposure point concentration, the 95 UCL is used for the concentration term for the RME scenario.

Use of 95 UCL or maximum detected concentrations to assess CTE exposures is contrary to the fundamental intent of a central tendency exposure analysis. The objective of the CTE analysis is to quantify average exposure. USEPA's *Guidance for Risk Characterization* (USEPA, Science Policy Council, February 1995) states,

> Central tendency descriptors generally reflect central estimates of exposure or dose. The descriptor addressing central tendency may be based on either the arithmetic

mean exposure (average estimate) or the median exposure (median estimate), either of which should be clearly labeled. The average estimate, used to approximate the arithmetic mean, can often be derived by using average values for all the exposure factors.

This is not limited to receptor-specific exposure parameters, such as soil ingestion rate or exposure frequency, but also includes exposure point concentrations.

USEPA (1992) guidance states that the 95 UCL of the arithmetic mean concentration is used because it accounts for uncertainties in the true mean due to limited sampling data. As data sets increase in size, the uncertainty decreases and there is less of a need to use a UCL to estimate the true mean. USEPA (1992) identifies that data sets with fewer than 10 samples may provide poor estimates of the mean concentration. For data sets with 10 or more samples, the uncertainty associated with the true mean is reduced, and the arithmetic mean is usually a reliable estimate of the true mean.

Thus, for data sets with fewer than 10 samples, the HHRA will be revised to use the 95 UCL for CTE exposure point concentrations. For data sets with more than 10 samples, the use of the arithmetic mean concentration to estimate the CTE exposure point concentration is appropriate and will continue to be used in the HHRA.

Tables summarizing the calculation of the 95 UCL concentrations and how EPCs were derived, including distribution (if appropriate) and UCL type, are provided in Appendix E of the draft HHRA. As requested, EPC tables in the main body of the report will be revised to include a footnote indicating how EPCs were derived (i.e., the lesser of the 95 UCL and maximum detect for RME EPCs and the 95 UCL or arithmetic mean for CTE EPCs).

USEPA Comment:

6. Section 8.0 presents the calculation of remedial goals (RG). As presented in the draft HHRA, RGs were not calculated for all COCs identified under the RME scenarios. Instead, CTE results were used to eliminate some medium-specific COCs. As discussed below with regard to Section 9.0, use of CTE results is the risk manager's decision and not the risk assessor's. The draft HHRA should be revised to calculate RGs for all RME COCs. The potential impact of CTE results can be discussed separately as part of the uncertainty analysis (Section 7.0).

AK Steel Response:

The results of CTE risk calculations were used to eliminate only two chemicals as potential COCs: 1) mercury in Great Miami River surface water, and 2) benzo(a)pyrene in groundwater. These two medium-specific chemicals will be carried into Section 8.0 as RME COCs and RGs will be identified.

USEPA Comment:

7. Section 9.0 presents the summary and conclusions of the draft HHRA. As presented, CTE results have been used to reduce or eliminate medium-specific RME COCs. Consistent with EPA risk assessment guidance, the risk assessment should objectively present RME and CTE results. EPA risk managers typically use RME results as the primary basis for decisions on whether, how much, and what type of remediation is necessary at a site. The risk manager's job is to review the CTE results and decide whether and how to factor these results into remedial decisions. The risk assessment should not make this decision for the risk manager. Therefore, Section 9.0 of the draft HHRA should be revised to present RME and CTE results separately and thus allow the risk managers to determine the use of these results in making remedial decisions.

AK Steel Response:

As noted in the response to general comment #6, mercury in Great Miami River surface water and benzo(a)pyrene in groundwater will be carried into the Summary and Conclusions (Section 9.0) as RME COCs. Section 9.0 will be revised to present CTE results as well as the RME risk characterization results.

SPECIFIC COMMENTS

USEPA Comment:

1. **Section 3.2, Page 3-2, Paragraph 4.** This section presents the data compilation and summary statistics. The paragraph identified addressed the treatment of non-detect or censored data in calculating statistics. The text states that the approach used to address censored data was selected from three methods presented in EPA's guidance for calculating EPCs (EPA 2002b). The three methods include (1) simple substitution, (2) bounding methods, and (3) distributional methods. The text states only that "Simple substitution was applied in this case." No justification or additional explanation is provided to support or document the basis of this selection. Problems associated with treatment of censored data in the draft HHRA are detailed in Specific Comment 33. The draft HHRA should be revised to address these problems.

AK Steel Response:

The following justification and additional explanation regarding use of simple substitution of ½ the SQL for censored data is proposed for addition to the HHRA in Section 3.2.

"The use of simple substitution of ½ the SQL as a proxy concentration for censored data is increasingly recognized as a statistical method that may not perform well. Recent guidance published by USEPA (USEPA, 2006b) and the most recent version of USEPA's ProUCL software Version 4.0 (USEPA, 2007a,b) recommends alternate and more robust methods for handling censored data in calculating summary statistics, including UCLs. However, a comparison of a subset of UCLs calculated using simple substitution of ½ SQL with UCLs calculated using alternate methods for handling censored data, specifically those provided in the ProUCL Version 4.0, revealed similar concentrations for most cases. Thus, use of simple substitution appears to be a reasonable approach for this risk assessment, and use of alternate methods for handling censored data is not expected to result in appreciably different risk results. The uncertainty associated with using simple substitution and the potential effect on risk assessment results is also discussed in the Uncertainty Analysis (Section 7.3.2 Estimation of Exposure Point Concentrations)."

Justification for the above is based in part on comparison of 95 UCL concentrations for key COCs at the ARMCO site calculated using: 1) the simple substitution method along with ProUCL Version 3.0 (the method used in the draft HHRA), and 2) ProUCL Version 4.0, which has incorporated various methods for handling censored data in the UCL calculation process (e.g., Kaplan Meier (KM) method, bootstrap method). Table A-1 of Attachment A to this Response to Comments document summarizes the results of this comparison for 12 cases including surface soil, surface and subsurface soil combined, surface water, and sediment. The frequency of detection varies among these 12 cases from as low as 35% to as high as 100%, and as few as 5 samples to as many as 70 samples.

As shown in Table A-1, the two sets of UCLs are the same or similar for eight of the 12 cases. The Version 4.0 UCL is higher for two cases and the Version 3.0 UCL calculated using ½ SQL for non-detect values is higher for two cases. Of the eight cases with a frequency of detection of 74% or less (i.e., the data sets with a higher percentage of censored data), the predicted UCL using Version 3.0 and simple substitution of ½ SQL is the same or lower than the Version 4.0 UCL in seven of the eight cases. In summary, simple substitution of ½ SQL appears to generate UCL concentrations that are similar to UCLs calculated using alternate statistical methods that have been incorporated into ProUCL Version 4.0, including for data sets with a higher percentage of censored data. Based on these findings, recalculation of statistics using alternate methods for handling non-detect values is not warranted. The revised HHRA will include in the discussion of exposure point concentrations presented in the Uncertainty Analysis the above information and analysis.

It should be noted that for AOCs where new data are collected, the latest USEPA ProUCL guidance will be used to calculate statistics for those AOCs.

USEPA Comment:

2. **Section 4.1, Page 4-1, Paragraph 4.** This section discusses the sources of dose-response values used in the HHRA. The sources of published dose-response values presented in the text are consistent with EPA's recommended hierarchy (EPA 2003a). However, the text states that provisional peer-reviewed toxicity values (PPRTV) were obtained from EPA Region 9's table of preliminary remediation goals (PRG) (EPA 2004b). This approach is problematic because various PPRTV values have been updated since 2004; as a result, specific PPRTV values used in the HHRA may not be current. Up-to-date PPRTV values may be obtained through EPA and Ohio Environmental Protection Agency (OEPA) staff with access to EPA's PPRTV database. The HHRA should be revised to request up-to-date PPRTV values as needed and the selection of chemical-specific dose response values revised accordingly.

AK Steel Response:

A letter will be sent to USEPA requesting up-to-date PPRTV values for chemicals where such values were obtained from the EPA Region 9 PRG table, and the HHRA will be updated accordingly.

USEPA Comment:

3. <u>Section 4.3, Page 4-3, Paragraph 4</u>. This section presents the carcinogenic dose-response assessment. In discussing the evaluation of available dose-response data, the text references "USEPA (2005a)." No such citation appears in the list of references (Section 10.0). The correct reference may be "USEPA 2006a," EPA's Integrated Risk Information System (IRIS). Section 4.3 should be revised as necessary to cite the correct reference.

AK Steel Response:

The reference will be corrected.

USEPA Comment:

4. <u>Section 4.6, Page 4-5, Paragraph 4</u>. This section summarizes the dose-response information (toxicity values) for dioxin that is used in the HHRA. The discussion does not identify an oral reference dose (RfD) for dioxin. Various risk assessments prepared for sites in EPA Region 5 have identified and used an oral RfD of 1E-09 milligram per kilogram-day (mg/kg-day) (EPA 2003b). The HHRA should be revised to incorporate this oral RfD for dioxin.

AK Steel Response:

The oral RfD referenced above was used in the draft HHRA (see Table 4-1). The text of the HHRA will be updated to mention the dioxin RfD.

USEPA Comment:

5. <u>Section 5.2, Page 5-2, Paragraph 3</u>. This section introduces the exposure scenarios that were evaluated in the draft HHRA. Three exposure scenarios likely to occur at or near the site were not evaluated in the draft HHRA, however. These exposure scenarios are: inhalation of volatile organic compounds (VOC) released from groundwater brought into the home for household use and inhalation of VOCs

released from groundwater into a construction or utility trench. Each of these exposure scenarios is discussed below.

- Inhalation of VOCs released from groundwater used for household tasks – groundwater may be brought into the home for household uses, including drinking, bathing, or washing clothes and dishes. VOCs in this groundwater may be released into indoor air and subsequently inhaled by residents. This source of VOCs is in addition to VOCs that have migrated from groundwater into residences through subsurface vapor intrusion. The draft HHRA should be revised to consider potential inhalation of VOCs released from groundwater used for household tasks.
- Inhalation of VOCs released from groundwater into a construction or utility trench – the text states that the construction/utility worker was not evaluated for potential exposure to chemicals of potential concern (COPC), including VOCs, in groundwater. These workers were not evaluated because groundwater is present at a depth of greater than 10 feet below ground surface (bgs) and construction/utility work is assumed to occur to a maximum depth of 10 feet bgs. However, VOCs may be released from groundwater, migrate through the vadose zone, and enter the air in a construction trench. The Virginia Department of Environmental Quality (VDEQ) has developed a model to estimate the concentration of VOCs in trench air (VDEQ 2005). The draft HHRA should be revised to consider potential inhalation of VOCs migrating from groundwater into the air in a construction or utility trench using the VDEQ methodology.

AK Steel Response:

It is possible that hypothetical future on-site residents could be exposed to VOCs in groundwater during household use of groundwater, such as showering and dish washing. The draft HHRA found potentially unacceptable carcinogenic risks and noncarcinogenic hazard indices for the hypothetical future on-site residential scenario for all exposure areas and for soil and/or groundwater. Given the unacceptable risks predicted for this scenario, the draft HHRA concluded in the Risk Characterization (Section 6.3.3) that further evaluation of the Hypothetical Future On-site Resident is not warranted. Rather, the draft HHRA states that institutional controls should be placed on the property such that future residential development and use of groundwater as drinking water are prohibited. Thus, in lieu of quantifying risks to the hypothetical future on-site resident from another pathway involving on-site groundwater, potential risks associated with this pathway will be discussed qualitatively in the Risk Characterization

(Section 6.3.3). This is consistent with the approach recommended in USEPA Region 4 risk assessment guidance (*Human Health Risk Assessment Bulletins – Supplement to RAGS*, USEPA Region 4, May 2000). The CSM figure will be revised to identify this additional potential exposure pathway for the hypothetical future on-site resident.

A screening-level analysis was performed to evaluate inhalation of VOCs that may volatilize from shallow groundwater and migrate up through the vadose zone into a trench for a construction/utility worker. This analysis was performed using the Virginia DEQ model identified above (http://www.deq.virginia.gov/vrprisk/tables.html), along with site-specific parameters for:

- depth to groundwater (25 feet which is conservative given that depths to water range from 20 to 40 feet),
- groundwater temperature (52 degrees F),
- soil type (silty clay loam in the vicinity of the groundwater wells with the highest VOC concentrations - MW-8S and MW-9S),
- trench depth (10 feet),
- trench length (50 feet), and
- trench width at worker breathing zone or 5 feet below grade (calculated to be 11 feet assuming the trench is dug using a standard backhoe bucket width of 3 feet and walls are sloped in accordance with the OSHA excavation standard for Type A (cohesive) soils).

Using maximum detected concentrations of VOCs and SVOCs in on-site shallow groundwater (all occur at MW-8S or MW-9S), concentrations of chemicals in trench air were predicted using the Virginia DEQ model. Using the predicted trench air concentrations and construction worker inhalation spreadsheets, predicted potential carcinogenic risks and noncarcinogenic hazard indices were all shown to be negligible (individual chemical risks were all well below 1E-06 and a hazard index of 0.1). Attachment B provides the calculation sheets for this screening-level analysis. Based on these findings, it is not necessary to include inhalation of VOCs from groundwater for the future construction worker in the HHRA. This screening-level analysis will be included in the revised HHRA and the CSM figure revised to note that this is a potential exposure pathway.

USEPA Comment:

6. **Section 5.4.1, Page 5-4, Paragraph 7, and Table 5-3.** This section discusses the exposure parameter assumptions for the trespasser under RME and CTE scenarios. Specific parameter values are presented in Table 5-3, and some of these parameters are also discussed in the text. One of the exposure parameters discussed in the text that requires revision is exposure frequency (EF). EF is discussed below. Other parameter values that require revision, but that are not discussed in the text, are presented in comments about Table 5-3.

   EF (days/year) was set at 26 days/year under the RME scenario and at 13 days/year under the CTE scenario. These values do not appear to be sufficiently health protective. Consider doubling the RME- and CTE-specific values to be adequately health-protective. The revised EF values represent approximately 2 days/week for 6 months (26 weeks) per year (52 days/year) under the RME scenario and 1 day/week for 6 months (26 weeks) per year (26 days/year) under the CTE scenario. However, receptor exposure may not be limited to only 6 months. If it is assumed that the 6 months described in the draft HHRA (see footnote b of Table 5-3) represent one-half of April, May, June, July, August, September, and one-half of October, receptors may also be exposed in late fall (mid-October through November) and early spring (March and early April). Exposure during these colder (but not yet winter) months will contribute to total trespasser exposure. Therefore, the draft HHRA should be revised to use trespasser EF values of 52 days/year under the RME and 26 days/year under the CTE scenarios to be adequately health-protective.

AK Steel Response:

The exposure frequency for the trespasser will be changed to 52 days/year under the RME scenario and 26 days/year under the CTE scenario.

USEPA Comment:

7. **Section 5.4.2, Page 5-5, Paragraphs 1 through 3.** This section discusses the exposure parameter assumptions for the current and future recreational angler under the RME and CTE scenarios. Specific parameter values are presented in Table 5-4, and some of these parameters are also discussed in the text. One of the exposure parameters discussed in the text that requires revision is the fish ingestion rate, discussed below.

   The fish ingestion rates for recreational anglers in the draft HHRA are 0.023 and 0.01 kilogram per day (kg/day) under the RME and CTE scenarios, respectively. These ingestion rates are based on detailed tables in EPA's 1997 "Exposure Factors Handbook" (EFH) (EPA 1997). EPA recommends similar but different fish ingestion rates in the text of Section 10.10.3 of EPA's EFH. Specifically, EPA recommends fish ingestion rates of 0.025 kg/day under the RME and 0.008 kg/day under the CTE scenarios for recreational freshwater anglers. The draft HHRA should be revised accordingly.

   The text states that "Mercury is the only surface water COPC identified as being bioaccumulative." Mercury concentrations in fish tissue were identified using a mercury-specific BCF value. However, fish may also take up and accumulate chemicals in sediment. PCBs were identified as a COPC for sediment. PCB concentrations in fish tissue should be estimated based on a PCB-specific BSAF value. EPA's Hazardous Waste Companion Database recommends a BSAF value of 2 for PCBs (EPA 2005a). The draft HHRA should be revised to estimate potential exposure to PCBs in fish tissue using BSAF values.

   The text further indicates that recreational anglers will be exposed to surface water only on their hands and forearms. The text suggests that anglers will wear shoes and pants or waders because of the heavy brush and broken glass in the sediment. It cannot be assumed that anglers regularly wear waders. If anglers wear shoes and pants while they fish, this clothing will not prevent exposure to surface water. Therefore, the draft HHRA should be revised to assume potential exposure to surface water to hands, forearms, feet, and lower legs.

Paragraph 3 should be revised to present specific values for the parameters discussed as was done in Sections 5.4.1 and 5.4.3.

AK Steel Response:
Fish ingestion rates will be revised as recommended by USEPA. The HHRA will be revised to assume that the recreational angler hands, forearms, feet, and lower legs are exposed to surface water. Paragraph 3 of Section 5.4.2 will be revised to present specific values for parameters used. The HHRA will be revised to address PCBs in sediment as discussed in the response to general comment #4.

USEPA Comment:

8. Section 5.4.3, Page 5-5, Paragraph 4. This section discusses the exposure parameter assumptions for the hypothetical future on-site resident (adult and child) under the RME and CTE scenarios. The text indicates that these receptors were evaluated for potential exposure to VOCs in indoor air (through vapor intrusion from groundwater). As discussed in Specific Comment 5, future on-site residents may also be exposed to VOCs released from groundwater brought into the home for household uses. The draft HHRA should be revised accordingly.

AK Steel Response:

See response to specific comment #5.

USEPA Comment:

9. **Section 5.4.4, Page 5-6, Paragraph 6**. This section discusses the exposure parameter assumptions for the current and future off-site resident (adult and child) under the RME and CTE scenarios. The text indicates these receptors will be exposed to COPCs in groundwater only through ingestion and dermal contact during bathing. However, VOCs in groundwater brought into homes for household uses may volatilize into indoor air. Therefore, the draft HHRA should be revised to evaluate potential exposure by current and off-site residents to VOCs released from groundwater brought into the home for household uses.

AK Steel Response:

Of the various household uses of groundwater, showering is expected to have the greatest potential for inhalation exposure to VOCs. The off-site resident's potential exposure to VOCs during household use of groundwater will be evaluated using a shower model, such as that of Foster and Chrostowski.

USEPA Comment:

10. **Section 5.4.5, Page 5-6, Paragraph 7**. This section discusses the exposure parameter assumptions for the future construction/utility workers under the RME and CTE scenarios. Although the text indicates that these receptors will be exposed through inhalation of volatile compounds, it is clear based on text elsewhere in the draft HHRA that only VOCs present in soil and released to the ambient air are considered. As discussed in Specific Comment 5, VOCs may be released from groundwater, migrate through the vadose zone, and enter the air in a construction

trench. The draft HHRA should be revised to consider potential inhalation of VOCs migrating from groundwater into the air in a construction/utility trench using the VDEQ methodology.

In addition, the text states that construction/utility workers are evaluated using an EF value of 130 days/year under the RME scenario. EPA's "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" recommends an EF value of 250 days/year under an RME scenario (EPA 2002c). The draft HHRA should be revised accordingly.

AK Steel Response:

See response to specific comment #5 regarding inhalation of VOCs from groundwater in a trench. Regarding exposure frequency, EPA's *Supplemental Guidance for Development Soil Screening Levels for Superfund Sites* states that exposure frequency for a construction worker is site-specific. In fact, in their example calculation provided in Appendix E (page E-21), EPA assumes an exposure period of six months. The assumption of 250 days/year is overly conservative for a colder, northern area of the country, and does not account for meteorological factors such as rain, snow and ice that limit construction activities and preclude contact with soil. It should also be noted that the exposure frequency for the construction worker is intended to reflect the number of days per year where the construction worker is involved in soil excavation activities, not necessarily the total number of days on-site. Further, it is unlikely that construction activities will last longer than six months even in the larger AOCs. Last, other HHRAs performed in Region 5 and reviewed by USEPA have used construction worker exposure frequencies ranging from 40 to 130 days (Sauget Area 1 (CERCLA), Sauget Area 2 (CERCLA), Reilly Indianapolis (RCRA)), but never 250 days. Based on the above, the RME construction worker exposure frequency of 130 days/year is appropriate for this HHRA. The HHRA will be revised to include the additional justification provided in this response.

USEPA Comment:

11. **Section 5.4.7, Pages 5-7 and 5-8, Paragraph 7 through 9 and 0 through 1.** These paragraphs discuss receptor-specific assumptions on surface area. Section 5.4.7 should be revised as necessary to reflect receptor-specific comments made to Sections 5.4.1 through 5.4.6.

AK Steel Response:

Section 5.4.7 will be revised accordingly.

USEPA Comment:

12. **Section 5.6.2, Page 5-15, Paragraph 1.** This section discusses modeled EPCs used in the draft HHRA. The text should be revised to discuss (1) volatilization of COPCs in groundwater to indoor air resulting from household use of groundwater (in contrast to subsurface vapor intrusion) (see Specific Comment 5), (2) bioaccumulation of COPCs in sediment to fish tissue (see Specific Comment 7), and (3) volatilization of COPCs from groundwater into the air inside a construction/utility trench (see Specific Comment 5).

AK Steel Response:

Section 5.6.2 will be revised to discuss prediction of PCB fish tissue concentrations from sediment using a BSAF. Discussions related to the other two pathways noted above are not necessary – see response to specific comment #5.

USEPA Comment:

13. **Section 5.6.2.3, Page 5-18, Paragraph 4.** This section discusses use of EPA's version of the Johnson and Ettinger model (JEM) to estimate the concentration of volatile COPCs that migrate via subsurface vapor transport into buildings. Paragraph 4 discusses well-specific information that was used in the modeling. The text should be revised to reference the appropriate well logs or the location of the well logs in the draft RI to support the information presented. In addition, the text

should be revised to clarify that — with the exception of the well-specific information presented in the in-text table — the JEM modeling used default parameter values and assumptions.

AK Steel Response:

Section 5.6.2.3 will be revised accordingly.

USEPA Comment:

14. **Section 5.6.2.4, Page 5-19, Paragraph 1**. This section discusses the prediction of EPCs for fish tissue. The text should be revised to also estimate the concentration of bioaccumulative COPCs in sediment using chemical-specific BSAF values (see Specific Comment 7).

AK Steel Response:

Section 5.6.2.4 will be revised accordingly.

USEPA Comment:

15. **Section 6.1, Page 6-2, Paragraph 0**. This section introduces the characterization of carcinogenic risk. Paragraph 0 states that COCs are defined as "any COPC that causes an exceedence of 10^{-4} risk level for a particular receptor." The choice of a risk level of 10^{-4} is based on the upper end of EPA's acceptable risk range of 10^{-4} to 10^{-6} (EPA 1990). The selection of the upper end, rather than the lower end, of EPA's risk range is not adequately health-protective. It is important that COCs be defined as any COPC that poses a risk that exceeds a 1E-06 risk level because (1) EPA can require remediation for any risks that exceed 1E-06, and (2) the total risk to which a particular receptor is exposed is based on the sum of multiple chemical-specific risks. The draft HHRA should be revised accordingly.

AK Steel Response:

See response to general comment #1.

USEPA Comment:

16. **Section 7.0, Pages 7-1 through 7-11**. This section presents the uncertainty analysis. Section 7.0 should be revised to discuss the uncertainty introduced by evaluating censored analytical results with a numerical value equal to one half the sample quantitation limit (SQL).

AK Steel Response:

As noted in response to specific comment #1, Section 7.3.2 of the uncertainty analysis will be revised to include a discussion of the uncertainty associated with using ½ SQL as the proxy concentration for non-detect (censored) analytical results.

USEPA Comment:

17. **Section 7.2.2, Page 7-5, Paragraphs 3 and 4**. Section 7.2.2 discusses uncertainties associated with the evaluation of carcinogenic dose-response. The text discusses uncertainties associated with extrapolating from high experimental to low environmental doses and the use of the linearized multi-stage (LMS) model to make these extrapolations. The discussion should reference EPA's most recent cancer guidelines (EPA 2005b).

AK Steel Response:

Section 7.2.2 will be revised to include reference to EPA's most recent cancer guidelines.

USEPA Comment:

18. **Section 7.3.2, Page 7-7, Paragraph 1**. Section 7.3.2 discusses uncertainties associated with the estimation of medium-specific EPCs. The text discusses the uncertainties associated with fish tissue modeling based on COPC-specific BCF values. Section 7.3.2 should be revised to discuss uncertainties associated with fish

tissue modeling based on COPC-specific BSAF values. Please see General Comment 4 for details.

AK Steel Response:

Section 7.3.2 will be revised to include discussion of the uncertainty associated with fish tissue modeling using a BSAF value.

USEPA Comment:

19. **Section 7.4.3, Page 7-9, Paragraph 1**. Section 7.4.3 presents CTE risk estimates. The text states that mean rather than upper-bound EPCs were used in the calculations to evaluate the CTE scenario. This approach is inconsistent with EPA Region 5 policy. Based on EPA guidance on calculating EPCs, the mean value should be calculated as the 95 UCL based on uncertainty associated with quantifying mean contaminant concentrations (EPA 1992). EPA makes no distinction in calculating mean concentrations under CTE as compared with RME scenarios. Therefore, Section 7.4.3 should be revised to use the same upper-bound EPCs under the CTE scenario as were used under the RME scenario.

AK Steel Response:

See response to general comment #5.

USEPA Comment:

20. **Section 8.0, Pages 8-1 and 8-2**. Section 8.0 presents the calculation of chemical-specific RGs. As presented in the text, RGs were calculated only for COCs identified under the RME scenario after the list was adjusted to eliminate several COCs based on CTE considerations. RGs should be calculated for all COCs identified under the RME scenario. No COCs should be removed based on CTE considerations. CTE risk and hazard results should be a stand-alone set of calculations that risk managers may consider in evaluating RME results. However, CTE results should not be used as part of the risk assessment to eliminate specific

COCs from consideration. The decision to focus attention on particular COCs is the risk manager's and not the risk assessor's. Furthermore, as discussed in General Comment 1 and Specific Comment 15, COCs should be defined as COPCs associated with risks greater than or equal to 1E-06 and hazards greater than 1. Section 8.0 should be revised accordingly.

AK Steel Response:

As noted in the response to general comment #6, only two chemicals (mercury in Great Miami River surface water and benzo(a)pyrene in groundwater) were eliminated from further consideration based on the results of the CTE evaluation. As discussed in the response to general comment #6, these two chemicals will be carried into the Section 8.0 as RME COCs and RGs will be identified. See response to general comment #1 regarding COC selection.

USEPA Comment:

21. **<u>Section 9.0, Pages 9-1 through 9-5</u>**. Section 9.0 presents the summary and conclusions for the risk assessment. Section 9.0 should be revised to reflect the comments on the remainder of the draft HHRA. In addition, Section 9.0 should be revised to present RME and CTE results separately. EPA uses RME results as the primary basis for decisions on the need for, type, and extent of site remediation. The decision to consider and how to factor in CTE results is the risk manager's to make. The draft HHRA should objectively present RME and CTE results separately; CTE results should not be used to eliminate or reduce the RME results. Section 9.0 should be revised accordingly.

AK Steel Response:

As stated in the response to general comment #7, Section 9.0 will be revised to present CTE results as well as the RME risk characterization results.

USEPA Comment:

22. **Section 10.0, Pages 10-1 through 10-4**. Section 10.0 presents the references cited in the text. Several of the references listed in Section 10.0 were apparently not cited in the text, including ASTM 2004; GSI 2000; Kissel and others 1998; Ohio EPA 2002; Singh, Singh, and Maichle 2004; and USEPA 2004c. The text also cites several references that are not listed in Section 10.0, including Ames and others 1987 (see page 4-1) and USGS 2001 (see page 7-7). The draft HHRA should be revised to ensure that all references cited in the text are listed in Section 10.0 and that all references listed in Section 10.0 are cited in the text.

AK Steel Response:
The HHRA will be revised accordingly.

USEPA Comment:

23. **Table 5-1**. Table 5-1 presents a summary of the potential receptors, exposure media, and exposure pathways considered in the draft HHRA. Table 5-1 should be revised consistent with comments on the text of the draft HHRA.

AK Steel Response:
Table 5-1 will be revised accordingly.

USEPA Comment:

24. **Table 5-3**. Table 5-3 presents exposure factors used for the current/future trespasser. As discussed in Specific Comment 6, consider increasing the EF value under the RME scenario from 26 to 52 days/year. The skin contacting medium used in the surface soil pathway (3,064 square centimeters [cm^2]) is based on exposure of hands, forearms, and lower legs. Receptors may also be exposed on their faces (consistent with EPA-recommended exposure of residents and industrial workers [EPA 2004a]). Consider revising the skin contacting medium to include potential facial exposure.

AK Steel Response:

The nature of contact with soil for a trespasser is not akin to that of a resident or industrial worker at the site. A trespasser's contact with on-site soil is likely to be incidental in nature, such as passing through the site to get to the river or another destination. This type of exposure is expected to result in limited opportunities for direct contact with soil, and particularly facial contact with soil, unlike a resident who may be digging in garden soil or an on-site worker performing site maintenance activities. The trespasser's body surface area of hands, forearms, and lower legs in contact with soil is appropriate.

USEPA Comment:

25. **Table 5-4**. Table 5-4 presents exposure factors used for the current/future recreational angler. As discussed in Specific Comment 7, the fish ingestion rates should be changed to 0.025 kg/day under the RME scenario and 0.008 kg/day under the CTE scenario. Similar to the discussion of EF for the trespasser in Specific Comment 6, consider increasing the EF value used in the surface water and sediment exposure pathways from 26 to 52 days/year under the RME scenario. As discussed in Specific Comment 7, the skin contacting medium for the surface water medium should be revised to include potential contact to lower legs and feet; the presence of pants will not eliminate exposure to these body parts.

    The exposure time for the surface water pathway is defined as 1 hour per day (hr/day). However, it is not unreasonable to assume that anglers may fish for a longer period each day. Therefore, consider revising the exposure time for the surface water pathway to 2 hr/day under the RME scenario.

    Finally, the sediment ingestion rate is listed as 50 milligram per day (mg/day). However, potential exposure to sediment while fishing is more akin to potential exposure to soil by an outdoor worker than by an "average" adult. Therefore, the sediment ingestion rate should be revised to 100 mg/day (EPA 2002c).

AK Steel Response:

As discussed in response to specific comments #6 and #7, the HHRA including Table 5-4 will be revised to use the EPA-requested fish consumption rates and body surface areas. The HHRA will also be revised to use the EPA-recommended RME and CTE exposure frequencies and the RME surface water exposure time for the recreational angler. However, use of a sediment ingestion rate of 100 mg/kg that is akin to an outdoor worker is not justified. The angler's hands (as well as forearms, lower legs, and feet) are assumed to be in contact with surface water for the time spent angling. Any sediment that may come in contact with the hands (and thus could subsequently be transferred to the mouth) will be washed off given that exposure to surface water is assumed to occur throughout the period of angling. Thus, the sediment ingestion rate of 50 mg/kg used in the draft HHRA is appropriate.

USEPA Comment:

26. **Table 5-5**. Table 5-5 presents exposure assumptions for the future on-site resident. The exposure time for adults (16.4 hr/day) under the RME scenario "assumes that adult spends time away from the household." Although many adults spend time away from home, some adults may be restricted to the home and may choose to or must stay indoors (for example, elderly or sickly individuals). Therefore, consider revising the exposure time for adults to 22 hr/day to reflect potential exposure to homebound individuals and to be more health protective. It should be noted that, even if it is assumed that adults spend some time away from home, the value of 16.4 hr/day indoors — coupled with an assumed outdoor exposure time of 2 hr/day — assumes an adult spends 5.6 hr/day away from home. Certainly, many adults spend considerably less than 5.6 hr/day away from home.

The exposure time for the child receptor used in the bathing pathway is 0.75 hr/event. In contrast, EPA (2004a) recommends an exposure time of 1 hr/event for a child receptor. Table 5-5 should be revised accordingly. (Note: this same comment applies also to Table 5-6).

AK Steel Response:
The exposure time indoors for adults will be changed to 22 hr/day. The exposure time for a child bathing will be changed to 1 hr/event. Tables 5-5 and 5-6 will be changed accordingly.

USEPA Comment:
27. Table 5-7. Table 5-7 presents exposure assumptions for the future construction worker. As discussed in Specific Comment 10, the exposure frequency for construction workers under the RME scenario is 250 days/year; Table 5-7 should be revised accordingly. In addition, an adherence factor of 0.2 milligrams per square centimeter (mg/cm^2) is used for the construction worker under both the RME and CTE scenarios. According to EPA's "Supplemental Guidance for Developing Screening Levels for Superfund Sites," an adherence factor of 0.3 mg/cm^2 should be used for construction workers (EPA 2002c). Again, Table 5-7 should be revised accordingly.

AK Steel Response:
See response to specific comment #10 regarding construction worker exposure frequency. The soil adherence factor for the construction worker will be changed to 0.3 mg/cm^2 and Table 5-7 will be revised accordingly.

USEPA Comment:
28. Table 6-25. Table 6-25 presents a summary of potential COCs. Table 6-25 should be revised as necessary to reflect comments made to other portions of the draft HHRA. Primarily, COCs should be defined as COPCs associated with risks greater than 1E-06 and hazards greater than 1. Furthermore, Table 6-25 should list all

COCs under the RME scenario; the list of COCs under the RME scenario should not be reduced by factoring in CTE results.

AK Steel Response:

See response to general comments #1 and #6. Table 6-25 will be revised accordingly.

USEPA Comment:

29. **Figures 3-2a and 3-2b**. Figures 3-2a and 3-2b present the soil sample locations for the northern and southern parcels. Both figures would be more understandable if site areas were labeled by name as well as by color. For example, it is difficult on Figure 3-2a to differentiate the colors of AOC 2 (closed landfill) and Block A (former slag processing area). The reader could more easily distinguish the two areas if both were identified by name with an arrow (as shown in Figure 5-2). Figures 3-2a and 3-2b should be revised accordingly.

AK Steel Response:

Figures 3-2a and 3-2b will be revised to label site areas by name and improve the color scheme used to distinguish site areas.

USEPA Comment:

30. **Figure 5-1**. Figure 5-1 presents the conceptual site model (CSM) for the draft HHRA. Several aspects of the CSM require revision or further clarification, as described below.

- The primary release mechanism from both transformers and former production areas is shown as direct releases. This term needs to be further clarified or changed. Transformers, for example, may leak, but direct releases from transformers are not expected. The CSM should be revised to clarify the use of the term "direct releases" or use an alternative term in each case.

- Surface soil is listed as one of the secondary sources. The only secondary release mechanism from surface soil is dust and volatile emissions. It should be noted that some portion of dust emissions is expected to deposit and will not remain forever in the ambient air. The CSM should be revised accordingly, possibly with a footnote. It should also be noted that contaminants may migrate from surface soil to surface water bodies via runoff and erosion. The CSM should be revised accordingly.

- The CSM shows only the potential for bioaccumulation from surface water into fish tissue. As discussed in General Comment 4 and Specific Comment 7, contaminants in sediment may also bioaccumulate into fish tissue. The CSM should be revised accordingly.

- Potential exposure to subsurface soil by future on-site workers and residents is incomplete or insignificant. However, risk assessments routinely consider potential exposure by similar receptors to subsurface soil assumed to be brought to the surface as a result of construction and excavation (see General Comment 3). The CSM should be revised accordingly.

AK Steel Response:

Revisions to the CSM presented in Figure 5-1 will be made as follows:

- The term direct release will be changed to leaks for transformers, and the term direct release will be changed to spills/releases for the former production area.

- A footnote will be added to the CSM noting that a portion of airborne dust eventually deposits to the surface of ground/buildings. The CSM will be revised to include erosion and runoff of surface soil to surface water.

- The CSM will be revised to show that bioaccumulatable chemicals in sediment may bioaccumulate into fish tissue.

- The CSM will be revised to show that exposure to subsurface soil by future on-site residents and future on-site workers is potentially complete and is addressed qualitatively in the risk assessment for the resident and quantitatively for the worker, as discussed in response to general comment #3.

USEPA Comment:

31. **Appendix E**. Appendix E presents outputs from the calculation of 95 UCLs using EPA's ProUCL Version 3.0 program. Several sheets (for example, benzo[a]pyrene in AOC 7 sediment) include the statement "Can't recommend Hall's Bootstrap UCL*" or similar. These sheets do not provide any explanation for this statement. Appendix E should be closely reviewed and all such statements clarified.

AK Steel Response:

The statement "Can't recommend Hall's Bootstrap UCL" is presented on the ProUCL output file. The occurrences of this statement in Appendix E will be reviewed and clarified.

USEPA Comment:

32. **Appendix F**. Appendix F presents the results of indoor air modeling from groundwater. The results for AOC 13 well MW-8S appear to be incorrect. The total thickness of soil stratum A is shown as 725 centimeters (cm), a value that matches the depth below grade to water table. However, the in-text table in Section 5.6.2.3 shows the thickness of Stratum A as 487.68 cm. Therefore, all results for well MW-8S should be rerun with the correct thicknesses of Strata A, B, and C. (The results for well MW-1S in the Southern Parcel can be used as an example.)

AK Steel Response:

The correct soil stratum A thickness of 487.68 cm for MW-8S will be used and the model rerun for that well location.

USEPA Comment:

33. **Appendix I**. Appendix I presents the background evaluation for surface soil. The statistical approach presented in Appendix I, including basic practices and statistical methods should be revised, especially the statistical power analysis. The draft

HHRA should be revised to address the significant issues presented below. It should be noted that additional issues may be identified after these fundamental issues are resolved.

Treatment of censored (nondetect) data. Use of simple substitution methods (replacement of nondetect concentrations with a value equal to one-half the SQL) biases statistical calculations and is unnecessary given the wide availability of alternative approaches. Older EPA guidance suggested that this practice is acceptable for samples where less than 15 percent of the data are censored, despite strong evidence to the contrary in the published literature over the last 15 to 20 years (Helsel 1990, 2005). More recent EPA guidance states that bias introduced by simple substitution methods is unacceptable even in cases where the frequency of nondetect data is less than 10 to 15 percent. This guidance continues that this practice is strongly contraindicated in environmental assessment studies (EPA 2006b, 2007a, 2007b). Please revise the draft HHRA to use an acceptable alternative approach for the treatment of censored (nondetect) data.

Response: When AK Steel developed the draft HHRA and associated appendices, the most recent accepted guidance from USEPA were used. These guidance manuals included recommendations for substitution of detection limits with ½ sample quantitation limits, as was done in the draft HHRA. New information becomes available on a daily basis. AK Steel negotiated the agreed-upon background evaluation approach with USEPA and its contractor, Weston Solutions, in good faith to prevent such disagreements in the review period.

The ultimate results of the draft HHRA and recommendations for additional evaluation of risks to human receptors would not change significantly in the absence of the background evaluation. However, since consistency with background is a vital tool in decisions regarding potential site-related risks, AK Steel believes this evaluation should remain in the HHRA.

As discussed in the Supplemental Field Investigation Work Plan, AK Steel will be collecting additional data for several AOCs. These additional data will be incorporated into the revised HHRA. For these AOCs, AK Steel will use ProUCL 4.0 (USEPA, 2007 a,b), which generally incorporates the suggestions made by USEPA in these comments regarding censored data, selection of test method, etc. This response to comments will be used to identify the specifics of the approach for the background evaluation of the revised HHRA. AK Steel anticipates that the background evaluation will only be revised for those AOCs where new data are collected in the supplemental field work. AK Steel is also considering collecting additional background soil samples, in which case ProUCL 4.0 will be used for the updated evaluation.

Comment:

On page 3, under the heading "Treatment of Non-Detects," it is stated that data sets with a large percentage of non-detects were excluded, and that non-detects in the remaining data sets were assumed not to introduce significant statistical bias. Exclusion of nondetect data is not an acceptable approach. Furthermore, the assumption that bias introduced by nondetects in the remaining data sets is negligible is not supported. Please revise this approach or provide references supporting the use of this approach.

Response: The language on page 3 describing the treatment of non-detects may not have been clear. AK Steel did not exclude non-detected data points from the data sets. Rather, data sets with >50% non-detects were excluded from the background evaluation altogether. This is generally consistent with USEPA (2007a,b) guidance, which recommends a cutoff of 40% non-detect. Constituents with FODs lower than 50% were not eliminated as COIs on the basis of background.

In the revised background evaluation for the additional data, AK Steel will use the tools of ProUCL 4.0 (USEPA, 2007 a,b), which has specific rules for the treatment of censored data.

Comment:

It is also unclear how censored measurements were treated in goodness-of-fit (GOF) testing. Both the bias introduced with improper treatment of censored measurements and the low power of GOF tests applied to data sets with small sample-sizes (fewer than 20 to 30 measurements) can compromise correct identification of the underlying distribution of chemical concentrations and appropriate selection of statistical tests. Please clarify how censored measurements were treated in GOF testing.

Response: Censored data in the goodness-of-fit tests were treated in the same manner as in the whole HHRA. One-half detection limits were used when frequency of detect was at least 50%. When frequency of detect was less than 50%, the data were not included in the background evaluation, and no goodness-of-fit tests were performed.

In the revised background evaluation for the additional data, AK Steel will use the tools of ProUCL 4.0 (USEPA, 2007 a,b), which has specific rules for the treatment of censored data.

Comment:

Parametric tests for comparing means, such as Student's *t* test, should not be used with censored data. Instead, alternative approaches designed to accommodate nondetects should be substituted (Helsel 2005; EPA 2006a). It appears that censored data treated by simple substitution methods were also used with the nonparametric Wilcoxon rank sum (WRS) test. The correct way of handling censored data with the WRS test is to set all nondetects at a concentration slightly lower than the minimum detected concentration (that is, tied at the lowest rank). When multiple detection limits are present, it is preferred to use the Gehan test (Helsel 2005; EPA 2002a, 2006b, 2007a, 2007b). Furthermore, sample sizes and detection frequencies should be provided alongside the results of statistical tests, and it is important to recognize the practical limits of applying certain tests with censored data. (For example, it is generally reported that the WRS test should not be applied when detection frequencies drop below 60 percent.)

Response: The overall approaches used to perform the background evaluation and calculate summary statistics are consistent with USEPA guidance in effect at the time the draft HHRA was prepared. Furthermore, the approach for the background evaluation (that of the USEPA 2002 background guidance) was agreed to with USEPA and Weston Solutions over the course of several conference calls in June 2006 (although it is recognized that not every detail of the approach was discussed) .

AK Steel acknowledges that the technology regarding the treatment of censored data in environmental data sets is an evolving topic. While literature sources are often available describing the potential impact of censored data (and other issues) on background screening or calculation of UCLs, AK Steel opted to follow accepted EPA guidance at the time the RI/FS Support Sampling Plan was developed, and ultimately approved by USEPA. New guidance materials have been published since the work plan was developed, the background approach discussed with USEPA, and the draft HHRA submitted. While these new methods may be more mathematically defensible, the ultimate question is whether or not the results of the HHRA would change significantly.

In the revised background evaluation for the additional data, AK Steel will use the tools of ProUCL 4.0 (USEPA, 2007 a,b), which has specific rules for the treatment of censored data and uses the Gehan test in lieu of the WRS test when multiple detection limits are present.

Comment:

Performing parametric two-population statistical tests on log-transformed data is generally not recommended (or should be applied with caution) as it introduces an additional complication — namely, that there is no straightforward interpretation of the results in the original measurement scale. Log-transformed data with hypothesis Test Form 2 and S>0 must be used with particular care, as there are several ways to carry out this analysis that are incorrect (see pages 5-6 in EPA 2007c).

Response: AK Steel agrees that care must be taken to ensure calculation and application of S > 0 in log-transformed data sets. The approach used calculated and added S on untransformed data, and the log of the value + S was then calculated. This prevents the multiplication by S referred to in EPA 2007c (i.e., adding S in log space is equivalent to multiplying by S).

AK Steel is also aware of concerns EPA has with relying on calculations conducted in log-space for making risk-based decisions. For those background comparisons conducted in log-space, AK Steel has also examined the results of the associated Wilcoxon Rank Sum test. In each case, the results of the two tests (log-transformed t-test and nonparametric Wilcoxon Rank Sum test) agree.

Comment:

Use of 1 standard deviation for the background data set to define a significant difference (S) in two-population tests may not be appropriate given the very small size of the background data set (n=9). Moreover, this simple measure of dispersion has no relevance for defining threshold concentrations of chemicals in terms of significant ecological or human health effects. Stating that 1 standard deviation was used for the "ease of statistical implementation" is not adequate technical justification. Please provide additional justification or revise, as necessary.

Response: EPA (2002a) provides information for determining S, but does not provide specific guidance or recommendations. AK Steel chose to use one standard deviation (δ) (or the 84.13th percentile to approximate δ as S) for the following reasons:

1) the minimum detectable difference (MDD) of the test should be less than S
2) EPA (2002a) notes that for sample sets with little contamination (e.g., a background dataset), "S is approximately equal to δ."
3) AK Steel had a limited number of background samples and selecting an S less than δ may require a large number of samples.

Determination of S based on a risk threshold (e.g., using a percentage of an SSL) is one option discussed by EPA (2002a). However, the purpose of the background evaluation was not to determine ecological or human health effects. Rather, the goal of the evaluation was to determine if concentrations of constituents in site soils are present because of site activities, or if they are present due to ubiquitous levels in the general area (i.e., are they background?).

AK Steel and EPA discussed the background approach prior to completing the evaluation. The approach for the background evaluation (that of the USEPA 2002 background guidance) was agreed upon with USEPA and Weston Solutions over the course of several conference calls in June 2006. AK Steel will use an S equal to δ in the revised background evaluation.

Comment:

The statistical power analysis has not been properly applied in the draft HHRA. Post-hoc evaluation of power does not add useful information in the context it is discussed in this appendix. It is stated that 80 to 90 percent power was the intended target, but establishing goals for power is meaningful only if applied *a priori* during project planning and the development of data quality objectives (DQO). Readily available DQO software (such as Visual Sampling Plan [VSP], Decision Errors

Feasibility Trials [DEFT]) uses *a priori* power analysis to aid in establishing minimum sample-size requirements. It is through appropriate selection of the minimum sample-size and specification of a meaningful effect-size that desired targets can be specified for the power of tests. A statement after the fact about whether a test has or does not have sufficient power is of little value. That is, if the null hypothesis is rejected, then by definition the test had sufficient power. Stating that a null hypothesis was not rejected because the test lacked power does not add value to interpreting the test results. Please provide additional explanation on the proper application of the statistical power analysis or delete it from the draft HHRA.

<u>Response</u>: AK Steel calculated power on the t-tests for a qualitative evaluation of the statistical tests. For t-tests where the null hypothesis was not rejected, a calculation of power on the t-test provides information pertaining to whether or not adequate data were collected for the test to provide a significant result. For instance, if a null was not rejected and the power was > 80%, it is highly likely that the test result demonstrated a true difference between the site mean and background mean + S. However, if power was low, no definitive conclusion could be drawn, and the results conservatively concluded that the two means are different when, in fact, additional data collected from the site or background may yield different results. By using the more conservative hypothesis (Test Form 2), the result of a test with insufficient power is a conclusion that the background + S is greater than site concentrations.

While the estimation of power is useful prior to sampling in order to design a sampling program, *it can only be calculated accurately after the sampling is complete*. Tools such as VSP and DEFT are very useful for sites where the number of samples to be collected is determined prior to sampling when a specific objective (such as the power of a t-test) is pre-established and adequate information regarding the distribution of the data for each contaminant is known. Following discussion with and approval by USEPA and Weston Solutions, AK Steel used VSP to help determine the number of bore holes to be installed at a number of the larger AOCs at the Hamiton site. However, in AK Steel's experience, these methods often calculate a requirement of a large number of samples (e.g., 40+) be collected from each area to satisfy a sampling design that includes estimation of number of samples to satisfy *a priori* the power of a statistical test, such as a t-test. This can be prohibitively expensive when a full suite of constituents is sampled, even though it may be only one or two constituents that have a high standard deviation, which drives the target number of samples (calculated using the few data points available prior to RI activities).

Comment:

Graphical presentations of the data, such as use of side-by-side box plots, would be a useful accompaniment to the statistical comparison tests. Graphical presentation of the data would also be made more useful if separate symbols were used to distinguish between detected and censored data, and if a horizontal line were drawn across the box plots to indicate the magnitude of difference between the sample means (or medians) that is used to define a significant difference (S).

Response: AK Steel agrees that graphical presentations of data could be used to visually demonstrate distribution. Graphical presentations of the data will be included in the revised HHRA.

Comment:

The tabular presentations of statistical test results included in Appendix I are missing critical information needed to interpret the test results. In particular, all tables should include the sample sizes and detection frequencies for both the site and background populations. The footnotes should also be revised for clarity. For example, (1) it is assumed that "—" is used to indicate that the distribution is treated as nonparametric, rather than just "not normal"; (2) the specific tests should be listed that were run to test the assumption of homogeneity of variance; and (3) it seems redundant (and the current presentation is unclear) to discuss identification of significant z-scores. It is adequate to state that significant p values (and possibly associated z-scores) are shown in bold text.

Response: The information requested in the tables is available in other tables in the HHRA. AK Steel will revise the tables to include sample size and frequency of detection.

Regarding the footnotes for the tables in Appendix I, the tables will be revised to more clearly explain the distribution of the data.

The test (F-test) used for homogeneity of variance was identified in the appendix text, Figure I-1, and the appendix tables, and did not change from constituent to constituent. Therefore, a footnote is not needed for clarification.

The WRS null hypothesis is that background equals site. Rejection of the null hypothesis alone (i.e., $p < 0.10$) does not provide adequate information to accept the project's alternative hypothesis which states that background is greater than site. The significance levels of the z-scores are included because the direction of the results of the WRS test is needed to determine if the significant result demonstrates that background is greater than site or background less than site. The tables will be revised in the HHRA to include a footnote that more clearly explains this nuance.

Additional Comments Received via September 19, 2007 Email from Eric Morton

USEPA Comment:

1) With regard to the 2nd comment in USEPA specific comment 33, it is recommended that chemicals with >50 percent nondetects not be excluded from the background evaluation. While some guidance suggests that measures of central tendency should not be compared when the FOD is below 60 percent, it is still possible to run tests that compare the right-hand tails of two distributions. It is suggested that the authors consider running the quantile (or slippage) test, which is now included in ProUCL 4.

AK Steel Response:
AK Steel will use an alternate test such as the quantile or slippage test per the ProUCL guidance in the background evaluation for the AOCs with newly collected data. For the existing background evaluation, AK Steel will not re-run the evaluation, since it is conservative to exclude the background evaluation.

USEPA Comment:
2) With regard to the last comment in USEPA specific comment 33, the response indicates that the authors are still treating the null hypothesis as a two-sided hypothesis (i.e., site equals background), but are stating the alternative hypothesis as a one-sided hypothesis (i.e., background is greater than site is stated in the response, although the convention is to state hypotheses in terms of the site data set). If this is a one-sided test (which is appropriate for background comparisons), then it is suggested that the phrasing of the null and alternative hypotheses be modified to conform with the recommendations provided in EPA guidance. The distinction between one- versus two-sided tests is important if the authors are using commercial statistical software that only includes the two-sided form for the WRS test (i.e., the p values need to be divided by 2 for the one-sided case, and users need to note the magnitude/direction of the z score to determine if the correct p value should be p/2 or 1-p/2).

AK Steel Response:
The Project Hypotheses are consistent with Test Form 2 of USEPA 2002 guidance:

> H_0: The mean of the contaminant concentration in the Site data set is greater than the mean of the Background data set by more than S ($\Delta > S$) where, S = 1s of the background data set ($u_{site} > u_{background}+S$).
> H_A: The mean of the contaminant concentration in the Site data set does not exceed the mean of the Background data set by S ($\Delta \leq S$)($u_{site} \leq u_{background}+S$).

The hypotheses are one-tailed. The software AK Steel used for the background reports the null hypothesis for the WRS as a two-tailed test. In the upcoming revised background evaluation, AK Steel will be using the ProUCL software instead of the software used in the Draft HHRA background evaluation.

To convert the two-tailed results to test the one-tailed Project Null, the magnitude and direction of the z-score was considered. AK Steel did not divide the reported p by 2. However, this oversight is conservative; the Project Null with not be rejected unless $p < 0.1$ when it could be rejected at $p < 0.2$ if p/2 was considered. Review of the results, however, indicate that there would be no difference to the outcome of the individual tests if p/2 was used in lieu of p to determine whether or not the Project Null hypothesis was rejected.

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Appendix K, Attachment A
ProUCL 3.0 to ProUCL 4.0 UCL Comparison

Table A-1
Comparison of UCLs Calculated Using Simple Substitution of 1/2 SQL and ProUCL Version 3.0 with UCLs Calculated Using Alternate Methods in ProUCL Version 4.0
AK Steel Former ARMCO Hamilton Plant

Area	Consituent	FOD	% FOD	Maximum Detect	Data Distribution	ProUCL 3 UCL Type (a)	ProUCL3 UCL	ProUCL4 UCL Type (b)	ProUCL4 UCL	Comment
Surface Soil (mg/kg)										
AOC 1	Arsenic	14 : 17 : 17	82%	18.00	Normal	Student's t	10.83	95% KM (t) UCL or 95% KM (Percentile Bootstrap) UCL	11.12 11.18	UCLs same/similar
AOC 1	Total PCBs	12 : 17 : 17	71%	110.00	Non-Parametric	99% Chebyshev (Mean, Sd)	70.97	99% KM (Chebyshev) UCL	100.50	ProUCL 4 higher
AOC 19	Arsenic	13 : 13 : 13	100%	101.00	Non-Parametric	95% Chebyshev (Mean, Sd)	48.37	Use 95% Chebyshev (Mean, Sd) UCL	48.37	UCLs same/similar
Surface and Surface Soil Combined (mg/kg)										
AOC 1	Benzo(a)pyrene	23 : 34 : 34	68%	180.00	Nonparametric	99% Chebychev (Mean, Sd)	59	99% KM (Chebyshev) UCL	59	UCLs same/similar
AOC 1	Naphthalene	22 : 34 : 34	65%	1100.00	Nonparametric	99% Chebychev (Mean, Sd)	355	99% KM (Chebyshev) UCL	357	UCLs same/similar
AOC 1	Total PCBs	17 : 34 : 34	50%	121.00	Nonparametric	99% Chebychev (Mean, Sd)	43	99% KM (Chebyshev) UCL	55	UCLs same/similar
AOC 13	Benzo(a)pyrene	48 : 70 : 70	69%	2900.00	Nonparametric	99% Chebychev (Mean, Sd)	458	97.5% KM (Chebyshev) UCL	305	ProUCL 3 higher
AOC 13	Naphthalene	48 : 70 : 70	69%	31000.00	Nonparametric	99% Chebychev (Mean, Sd)	4860	97.5% KM (Chebyshev) UCL	3229	ProUCL 3 higher
AOC 13	Total PCBs	25 : 70 : 70	36%	24.00	Nonparametric	97.5% Chebychev (Mean, Sd)	3.07	95% KM (Chebyshev) UCL	3.25	UCLs same/similar
Sediment (mg/kg)										
Great Miami River	Benzo(a)pyrene	10 : 10 : 10	100%	170	Non-parametric	99% Chebyshev (Mean, Sd) UCL	186.11	99% Chebyshev (Mean, Sd) UCL	186.10	UCLs same/similar
Great Miami River	TOTAL PCBs	9 : 10 : 10	90%	2	Approximate Gamma UCL	Gamma Distribution (0.05)	0.96	95% KM (Chebyshev) UCL	1.50	ProUCL 4 higher
Surface Water (ug/L)										
Great Miami River	Mercury	2 : 5 : 5	40%	0.19	Normal	Student's-t	0.14	95% KM (t) UCL or 95% KM (% Bootstrap) UCL	0.164 0.19	UCLs same/similar

Notes:
(a) UCL calculated using 1/2 SQL for censored data and Version 3.0 ProUCL (USEPA, 2004).
(b) UCL calculated using Version 4.0 ProUCL (USEPA, 2007), which uses alternative methods for handling censored data.

Appendix K, Attachment B
Screening Evaluation – Excavation Trench Model for Construction Worker

Screening Level Excavation Trench Scenario Evaluation

A screening-level analysis was performed to evaluate inhalation of VOCs that may volatilize from shallow groundwater and migrate up through the vadose zone into a trench for a construction/utility worker. This analysis was performed using the Virginia Department of Environmental Quality (DEQ) model (http://www.deq.virginia.gov/vrprisk/tables.html), along with site-specific parameters for:

- depth to groundwater (25 feet which is conservative given that depths to water range from 20 to 40 feet),
- groundwater temperature (52 degrees F),
- soil type (silty clay loam in the vicinity of the groundwater wells with the highest VOC concentrations - MW-8S and MW-9S),
- trench depth (10 feet),
- trench length (50 feet), and
- trench width at worker breathing zone or 5 feet below grade (calculated to be 11 feet assuming the trench is dug using a standard backhoe bucket width of 3 feet and walls are sloped in accordance with the OSHA excavation standard for Type A (cohesive) soils).

Using maximum detected concentrations of VOCs and SVOCs in on-site shallow groundwater (all occur at MW-8S or MW-9S), concentrations of chemicals in trench air were predicted using the Virginia DEQ model. Using the predicted trench air concentrations and construction worker inhalation spreadsheets, predicted potential carcinogenic risks and noncarcinogenic hazard indices were all shown to be negligible (individual chemical risks were all well below 1E-06 and a hazard index of 0.1). The calculation sheets for this screening-level analysis are provided on the following pages. Based on these findings, it is was concluded that it was not necessary to include inhalation of VOCs from groundwater for the future construction worker in the HHRA.

ATTACHMENT B

WORKSHEETS AND RISK SPREADSHEETS
VDEQ TRENCH MODEL – VOLATILIZATION FROM GROUNDWATER DEEPER THAN 10 FT TO TRENCH AIR

FUTURE CONSTRUCTION WORKER

RESPONSE TO COMMENTS ON DRAFT HHRA

Table B-1
Inputs to Trench Model - Volatilization from Groundwater Deeper than 10 ft bgs
AK Steel Former ARMCO Hamilton Site
New Miami, Butler County, Ohio
Response to Comments on Draft HHRA

For Effective Diffusion Coefficients			For Emission Flux and Concentration in Trench			Trench dimensions		
Hv	450	cm	CF1	1.00E-03	L/cm3	Length	50	ft (d)
ACvad	0.284	cm3/cm3 (a)	CF2	1.00E+04	cm2/m2		15.24	m
PorVad	0.482	cm3/cm3 (a)	CF3	3600	s/hr	Width	11	ft (e)
T	52	F (b)	Lgw	25	ft (c)		3.35	m
T	284	K	Lgw	762	cm	Depth	10	ft (f)
R	8.20E-05	atm-m3/mol-K	F	1			3.05	m
			ACH	360	hr-1	Width/Depth	1.10	

Notes:
Model source: VDEQ, VRP 2007. Model defaults used unless otherwise noted.
(a) - Site-specific soil type of silty clay loam. Volumetric air content in vadose zone soil calculated by subtracting the volumetric water content in vadose zone soil (0.198 cm3/cm3) from total soil porosity (USEPA J&E model LOOKUP table for silty clay loam (USEPA 2004)).
(b) - Site-specific shallow groundwater temperature (11 degrees celsius).
(c) - Site-specific depth to shallow groundwater.
(d) - Length of open trench is to be excavated only so far in advance of pipe laying as is necessary to maintain continuous work and shall not exceed 25 feet at the end of day or work cessation (Butler County, Ohio Department of Environmental Services, Section 2550 - Trench Excavation). http://des.butlercountyohio.org/html/contractors/StandardSpecifications.cfm
(e) - Calculated at worker breathing zone or 5 feet below grade assuming the trench is dug using a standard backhoe bucket width of 3 feet and walls are sloped in accordance with the OSHA excavation standard for Type A (cohesive) soils.
(f) - Maximum depth of excavation.

Table B-2
Predicted Concentrations of COPCs in Trench Air
AK Steel Former ARMCO Hamilton Site
New Miami, Butler County, Ohio
Response to Comments on Draft HHRA

Table 3.7 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: (Groundwater present at ~ 25 ft bgs)	CAS No.	Concentration of Contaminant in Groundwater Cgw ug/L	Volatilization Factor VF L/m3	Concentration of Contaminant in Trench Ctrench ug/m3	Concentration of Contaminant in Trench Ctrench mg/m3
Volatile Organic Compounds (VOCs)					
Benzene	71-43-2	1.10E+04	9.75E-05	1.07E+00	1.07E-03
Ethylbenzene	100-41-4	6.30E+02	1.18E-04	7.44E-02	7.44E-05
Isopropylbenzene	98-82-8	9.40E+01	1.51E-02	1.42E+00	1.42E-03
Styrene	100-42-5	2.80E+02	3.90E-05	1.09E-02	1.09E-05
Toluene	108-88-3	2.10E+04	1.15E-04	2.42E+00	2.42E-03
Total Xylenes	TOTAL XYLEN	7.70E+03	7.09E-05	5.46E-01	5.46E-04
Semivolatile Organic Compounds (SVOCs)					
Acenaphthene	83-32-9	4.30E+02	1.45E-06	6.22E-04	6.22E-07
Benzo(a)anthracene	56-55-3	6.10E+01	3.41E-08	2.08E-06	2.08E-09
Benzo(a)pyrene	50-32-8	4.50E+01	9.70E-09	4.37E-07	4.37E-10
Benzo(b)fluoranthene	205-99-2	4.10E+01	5.53E-07	2.27E-05	2.27E-08
Benzo(k)fluoranthene	207-08-9	1.60E+01	4.14E-09	6.63E-08	6.63E-11
1,1'-Biphenyl	92-52-4	9.80E+01	2.42E-06	2.37E-04	2.37E-07
Carbazole	86-74-8	3.00E+02	1.35E-10	4.04E-08	4.04E-11
Chrysene	218-01-9	4.90E+01	4.93E-07	2.42E-05	2.42E-08
Dibenzo(a,h)anthracene	53-70-3	4.90E+00	6.93E-11	3.40E-10	3.40E-13
Dibenzofuran	132-64-9	2.10E+02	1.03E-07	2.17E-05	2.17E-08
2,4-Dimethylphenol	105-67-9	3.00E+03	2.49E-08	7.46E-05	7.46E-08
Fluoranthene	206-44-0	2.40E+02	8.87E-08	2.13E-05	2.13E-08
Fluorene	86-73-7	2.90E+02	5.59E-07	1.62E-04	1.62E-07
Indeno(1,2,3-cd)pyrene	193-39-5	1.60E+01	7.84E-09	1.25E-07	1.25E-10
2-Methylnaphthalene	91-57-6	7.60E+02	5.42E-06	4.12E-03	4.12E-06
2-Methylphenol	95-48-7	4.70E+02	1.77E-08	8.33E-06	8.33E-09
4-Methylphenol	106-44-5	1.20E+02	1.17E-08	1.40E-06	1.40E-09
Naphthalene	91-20-3	1.30E+04	5.69E-06	7.40E-02	7.40E-05
Phenanthrene	85-01-8	4.90E+02	1.60E-07	7.86E-05	7.86E-08
Pyrene	129-00-0	1.60E+02	6.10E-08	9.77E-06	9.77E-09

Source: VDEQ, VRP 2007.

Table B-3
Assumptions for Future Construction Worker Inhalation of Trench Air from Groundwater
AK Steel Former ARMCO Hamilton Site
New Miami, Butler County, Ohio
Response to Comments on Draft HHRA

Receptors Evaluated:	
Receptor 1:	Future Construction Worker - RME

CARCINOGENIC AND NONCARCINOGENIC ASSUMPTIONS FOR FUTURE CONSTRUCTION WORKER - RME INHALATION OF TRENCH AIR FROM GROUNDWATER		**Assumed Value**	**Units**	**Calculated Value**
Inhalation Rate	Future Construction Worker - RME	20	(m^3 air/day)	($2.5m^3$/hr x 8hrs/day)
Body Weight	Future Construction Worker - RME	70	(kg)	
Exposure Frequency	Future Construction Worker - RME	130	(days)/365(days) =	3.56E-01
Exposure Duration (cancer)	Future Construction Worker - RME	1	(yrs)/70(yrs) =	1.43E-02
Exposure Duration (noncancer)	Future Construction Worker - RME	1	(yrs)/1(yrs) =	1.00E+00
Lifetime		70	(years)	

Table B-4
Calculation of Potential Carcinogenic Risk - Inhalation of Trench Air from Groundwater
AK Steel Former ARMCO Hamilton Site
New Miami, Butler County, Ohio
Response to Comments on Draft HHRA

Chemical	Unit Concentration In Air (mg/m^3 air)	Inhalation Cancer Slope Factor (mg/kg-day)$^{-1}$	ADDInh Future Construction Worker - RME (mg/kg-day)	Lifetime Average Daily Dose - Inh. (mg/kg-day)	Unit Excess Lifetime Cancer Risk - Inhalation
1,1-Biphenyl	2.37E-07	NA	3.45E-10	3.45E-10	NC
2,3,7-8 TCDD TEQ		1.50E+05	0.00E+00	NA	NC
2,4-Dimethylphenol	7.46E-08	NA	1.08E-10	1.08E-10	NC
2-Methylnaphthalene	4.12E-06	NA	5.99E-09	5.99E-09	NC
Acenaphthene	6.22E-07	NA	9.04E-10	9.04E-10	NC
Acenaphthylene		NA	0.00E+00	NA	NC
Aluminum		NA	NA	NA	NC
Anthracene		NA	0.00E+00	NA	NC
Antimony		NA	0.00E+00	NA	NC
Arsenic		1.51E+01	NA	NA	NC
Barium		NA	NA	NA	NC
Benzene	1.07E-03	2.70E-02	1.56E-06	1.56E-06	4.21E-08
Benzo(a)anthracene	2.08E-09	3.10E-01	3.03E-12	3.03E-12	9.38E-13
Benzo(a)pyrene	4.37E-10	3.10E+00	6.35E-13	6.35E-13	1.97E-12
Benzo(b)fluoranthene	2.27E-08	3.10E-01	3.30E-11	3.30E-11	1.02E-11
Benzo(g,h,i)perylene		NA	0.00E+00	NA	NC
Benzo(k)fluoranthene	6.63E-11	3.10E-02	9.64E-14	9.64E-14	2.99E-15
Cadmium		6.30E+00	0.00E+00	NA	NC
Carbazole	4.04E-11	NA	5.87E-14	5.87E-14	NC
Chromium (total)		NA	NA	NA	NC
Chrysene	2.42E-08	3.10E-03	3.51E-11	3.51E-11	1.09E-13
Copper		NA	0.00E+00	NA	NC
Cyanide		NA	NA	NA	NC
Dibenz(a,h)anthracene	3.40E-13	3.10E+00	4.94E-16	4.94E-16	1.53E-15
Dibenzofuran	2.17E-08	NA	3.15E-11	3.15E-11	NC
Ethylbenzene	7.44E-05	NA	1.08E-07	1.08E-07	NC
Fluoranthene	2.13E-08	NA	3.10E-11	3.10E-11	NC
Fluorene	1.62E-07	NA	2.35E-10	2.35E-10	NC
Indeno(1,2,3-cd)pyrene	1.25E-10	3.10E-01	1.82E-13	1.82E-13	5.65E-14
Iron		NA	NA	NA	NC
Isopropylbenzene	1.42E-03	NA	2.06E-06	2.06E-06	NC
Lead		NA	0.00E+00	NA	NC
Manganese		NA	NA	NA	NC
Mercury		NA	0.00E+00	NA	NC
Naphthalene	7.40E-05	NA	1.08E-07	1.08E-07	NC
o-Cresol (2-Methylphenol)	8.33E-09	NA	1.21E-11	1.21E-11	NC
p-Cresol (4-Methylphenol)	1.40E-09	NA	2.04E-12	2.04E-12	NC
Phenanthrene	7.86E-08	NA	1.14E-10	1.14E-10	NC
Phenol		NA	0.00E+00	NA	NC
Pyrene	9.77E-09	NA	1.42E-11	1.42E-11	NC
Selenium		NA	NA	NA	NC
Styrene	1.09E-05	NA	1.59E-08	1.59E-08	NC
Thallium		NA	0.00E+00	NA	NC
Toluene	2.42E-03	NA	3.52E-06	3.52E-06	NC
Total PCBs		2.00E+00	0.00E+00	NA	NC
Total Xylenes	5.46E-04	NA	7.93E-07	7.93E-07	NC
Trichloroethene		7.00E-03	0.00E+00	NA	NC
Vanadium		NA	NA	NA	NC
Zinc		NA	0.00E+00	NA	NC

Table B-5
Calculation of Potential Noncarcinogenic Hazard - Inhalation of Trench Air from Groundwater
AK Steel Former ARMCO Hamilton Site
New Miami, Butler County, Ohio
Response to Comments on Draft HHRA

Chemical	Unit Concentration In Air (mg/m^3 air)	Inhalation Reference Dose (mg/kg-day)	ADDinh Future Construction Worker - RME (mg/kg-day)	Chronic Average Daily Dose-Inh (mg/kg-day)	Unit Hazard Index - Inhalation
1,1-Biphenyl	2.37E-07	5.00E-02	2.41E-08	2.41E-08	4.83E-07
2,3,7-8 TCDD TEQ		NA	0.00E+00	NA	NC
2,4-Dimethylphenol	7.46E-08	2.00E-02	7.59E-09	7.59E-09	3.80E-07
2-Methylnaphthalene	4.12E-06	8.57E-04	4.19E-07	4.19E-07	4.89E-04
Acenaphthene	6.22E-07	6.00E-02	6.33E-08	6.33E-08	1.05E-06
Acenaphthylene		6.00E-02	0.00E+00	NA	NC
Aluminum		1.43E-03	NA	NA	NC
Anthracene		3.00E-01	0.00E+00	NA	NC
Antimony		1.14E-04	0.00E+00	NA	NC
Arsenic		8.57E-06	NA	NA	NC
Barium		1.40E-04	NA	NA	NC
Benzene	1.07E-03	8.57E-03	1.09E-04	1.09E-04	1.27E-02
Benzo(a)anthracene	2.08E-09	3.00E-02	2.12E-10	2.12E-10	7.06E-09
Benzo(a)pyrene	4.37E-10	3.00E-02	4.44E-11	4.44E-11	1.48E-09
Benzo(b)fluoranthene	2.27E-08	3.00E-02	2.31E-09	2.31E-09	7.69E-08
Benzo(g,h,i)perylene		3.00E-02	0.00E+00	NA	NC
Benzo(k)fluoranthene	6.63E-11	3.00E-02	6.75E-12	6.75E-12	2.25E-10
Cadmium		5.71E-05	0.00E+00	NA	NC
Carbazole	4.04E-11	NA	4.11E-12	4.11E-12	NC
Chromium (total)		NA	NA	NA	NC
Chrysene	2.42E-08	3.00E-02	2.46E-09	2.46E-09	8.20E-08
Copper		NA	0.00E+00	NA	NC
Cyanide		2.00E-02	NA	NA	NC
Dibenz(a,h)anthracene	3.40E-13	3.00E-02	3.46E-14	3.46E-14	1.15E-12
Dibenzofuran	2.17E-08	2.00E-03	2.21E-09	2.21E-09	1.10E-06
Ethylbenzene	7.44E-05	2.86E-01	7.57E-06	7.57E-06	2.65E-05
Fluoranthene	2.13E-08	4.00E-02	2.17E-09	2.17E-09	5.42E-08
Fluorene	1.62E-07	4.00E-02	1.65E-08	1.65E-08	4.12E-07
Indeno(1,2,3-cd)pyrene	1.25E-10	3.00E-02	1.28E-11	1.28E-11	4.25E-10
Iron		NA	NA	NA	NC
Isopropylbenzene	1.42E-03	1.14E-01	1.44E-04	1.44E-04	1.26E-03
Lead		NA	0.00E+00	NA	NC
Manganese		1.43E-05	NA	NA	NC
Mercury		8.57E-05	0.00E+00	NA	NC
Naphthalene	7.40E-05	8.57E-04	7.53E-06	7.53E-06	8.78E-03
o-Cresol (2-Methylphenol)	8.33E-09	5.00E-02	8.48E-10	8.48E-10	1.70E-08
p-Cresol (4-Methylphenol)	1.40E-09	5.00E-02	1.43E-10	1.43E-10	2.86E-09
Phenanthrene	7.86E-08	3.00E-01	8.00E-09	8.00E-09	2.67E-08
Phenol		5.70E-02	0.00E+00	NA	NC
Pyrene	9.77E-09	3.00E-02	9.94E-10	9.94E-10	3.31E-08
Selenium		NA	NA	NA	NC
Styrene	1.09E-05	2.86E-01	1.11E-06	1.11E-06	3.89E-06
Thallium		NA	0.00E+00	NA	NC
Toluene	2.42E-03	1.43E+00	2.47E-04	2.47E-04	1.73E-04
Total PCBs		2.00E-05	0.00E+00	NA	NC
Total Xylenes	5.46E-04	2.86E-02	5.55E-05	5.55E-05	1.94E-03
Trichloroethene		1.70E-01	0.00E+00	NA	NC
Vanadium		NA	NA	NA	NC
Zinc		NA	0.00E+00	NA	NC